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THE DEPRECIATION OF PRIME MOVERS.

Conservative owners of power plants now recognize the necessity of providing an allowance for depreciation in calculating the total cost of producing electricity. There is a tendency, however, in some cases to overlook the difference between useful life and total life of equipment, with the result that the depreciation charge is altogether too low. Speaking of this recently, Dr. Charles P. Steinmetz pointed out that there is a large part of depreciation which goes on whether the machinery is used or not. Apparatus wears out even when it is not used. Furthermore, it is not merely the charging off of the total life so that the cost will be extinguished when the life is ended; but in considering depreciation it is necessary to take the useful life into account. Thus, with an incandescent lamp it is generally recognized that in the cost of renewals the total length of possible life is not figured, but instead it is assumed that after about 500 hours of running the useful life of the lamp will be ended through blackening. It could still be run and some life obtained from it, but the efficiency falls off so much that the cost of power is more than the cost of a new lamp; hence it is more economical to throw the old lamp away or turn it to account on a salvage basis.

This reasoning applies to all apparatus, and notably prime movers at the present time. A prime mover may be still in first-class condition and power may be gotten out of it, but its useful life may be ended, and, while it could be operated, it is more economical to replace it with new machinery, because the increased efficiency of the new apparatus will in general amount to more than the cost of the new installation. The useful life of equipment largely depends on its character. In those fields of the industry where rapid advancement takes place the useful life is naturally much shorter than in lines where the advance is very slow. In the prime-mover field at present the advance is very rapid. The steam turbine has come in and is rapidly covering the field. The gas engine is in process of development, and we must expect the useful life of prime movers, therefore, to be short.

If the gas engine and steam turbine rapidly advance and so have relatively short useful lives, that does not mean that the steam engine has a longer useful life, because new types of machinery correspondingly shorten the useful life of the old types. If there were no steam turbines or gas engines the steam engine could be said to have a long, useful life. As a matter of fact the useful life of the steam engine is practically as short as that of the steam turbine and the gas engine, for the first must compete with the other two. This means that it must

correspondingly improve, and an engine built ten years ago would tend to be beyond its useful life or else be superseded by the turbine or the gas engine. This is merely the inherent result of the rapid advance with all types of equipment as they are developed. They all share the same useful life. It is only a few years since the first important steam-turbine station was installed with units of 5,000 kilowatts capacity. Only a few weeks ago the first of these machines was replaced, not because its life was used up, but because economy has increased so much in this time that while the original unit is still in first-class operating condition, it is preferable to supersede it by a new turbine having a rating of 12,000 kilowatts, a reduced steam consumption per kilowatt-hour of about nine pounds, and no greater space requirements than those of the original 5,000-kilowatt outfit. Fortunately for the plant owner, the cost of replacing a machine in good condition, but not capable of the highest economy, is generally much reduced in net expenditure by the salvage which accrues through its sale. A machine which for various reasons is not suited to longer carry the severe loads and generate at the efficiency of a large city station may still prove of the greatest usefulness in the less highly developed parts of the country. It is one of the penalties of progress that costly equipment must be superseded often before its life is consumed, in order that total costs of operation may be lowered.

TREATING A TOWN AS A PRIVATE CUSTOMER.

An interesting feature of the development of the suburban business of the Edison Electric Illuminating Company of Boston is the sale of current in certain cases to a municipality on the basis of the company's regular rates. The price paid depends on the quantity of energy consumed by the town, generally speaking, and the community as a whole is treated precisely like any other large consumer. Thus, in the case of the town of Wellesley, the town purchased last year 396,040 kilowatt-hours at its substation switchboard; of these, 126,390 kilowatt-hours were used by street series lamps; 4,600 kilowatt-hours for street lights on commercial circuits; 800 kilowatt-hours by the substation itself; and 264,250 kilowatt-hours were metered at the substation on commercial circuits. The average cost of current per kilowatt-hour was 3.77 cents. At the time when the town made its contract with the company it was figured that the consumption would be large enough to assure a rate of about four cents per kilowatt-hour at the substation, which is owned by the municipality. The electrical service supplied to the substation is generated at the company's large steam-turbine plant on the water's edge in Boston, and transmitted at 6,000 volts or thereabouts to the distributing centre at Wellesley.

The town under this scheme takes care of the business end of the service, and charges a price above that paid to the company, which will enable the running expenses, bond interest, maintenance and fixed charges of distribution in the town to be met. The lighting rate, for example, as stated in the latest town report, is thirteen cents per kilowatt-hour, and the power rate ten cents. The arrangement enables the town to control the conditions of service inside its borders and at the same time avoid the pitfalls of municipal ownership. It secures a rate probably lower than would result if the town attempted its own generation in a small and relatively inefficient station, and incidentally pays for its street lighting out of the commercial lighting and power revenue. The company, on its part, obtains a reliable, continuous and substantial customer.

THE NATIONAL ELECTRICAL CODE.

The annual meeting of the Electrical Committee of the Underwriters' National Electric Association was held in New York city on March 24 and 25. This is the body representing the electrical service of the National Board of Fire Underwriters. About two hundred men from this country and Canada were present, a number of manufacturers and representatives of other interests in the electrical and fire-insurance underwriting industries being also in attendance. A spirited and intelligent discussion was held upon the various suggestions made by the sub-committees of the Electrical Committee and by those who had contributed ideas with a view of either simplifying or making more comprehensive the rulings of the National Electrical Code.

As the proposed changes were circulated prior to the meeting, the suggestions were well considered, and it was apparent that in most cases the subjects had been thoroughly investigated, with the result that the measures for bringing the Underwriters' rules into harmony with the advance and application of electricity were devoid of impulsive or inadequately considered suggestions, as may have occurred in earlier years.

There was little new matter brought up for discussion and comparatively minor changes are to be noticed in the suggested changes and modifications. It is significant of the fact that so standardized have the rules become, and so fitted are they for present-day installation and construction, that the secretary announced that unless something extraordinary developed the next meeting would not be held until March, 1911.

The Committee on Rule 13A, which considered the grounding of the neutral of alternating-current circuits carrying not in excess of 150 volts, was up again for discussion, and the Underwriters announced that they were willing to consider the life hazard as well as the fire hazard, but that they saw no advantage in and could not consistently advocate a ruling that did not adequately cover the fire hazard. The upshot of the discussion was that, as usual, the matter has again been referred to the committee.

On Friday afternoon, following the meeting of the Electrical Committee, the National Conference on Standard Electrical Rules held its meeting and took action on several matters of detail which were referred to it by the Underwriters' meeting. A general review was given to the action of the preceding two days' conference, but nothing of extraordinary interest was developed.

In connection with these two meetings, the joint conference of the four national engineering societies, which was

held in the Engineering Societies Building, on Wednesday evening, and which was devoted to the discussion of preservation of national resources, is of interest. One of the speakers was Mr. Charles Whiting Baker, and he discussed the waste of our national resources by fire. Among other remarks, he stated that the number of buildings burned each year would occupy both sides of a street reaching from New York to Chicago. With a fire traversing this highway at the rate of three miles per day, at every one-eighth mile one person would be seriously injured, and in each distance of one-and-one-half miles one person would be burned by fire, probably exceeding in this manner the cruelties of the Auto de Feu of the Middle Ages.

THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

The annual report of the directors of the American Telephone and Telegraph Company to the stockholders for the year ended December 31, 1908, makes interesting reading indeed. Not only is this a record of earnings and expenses, but it is also a philosophic treatise on the subject of telephony. President Theodore N. Vail analyzes several of the elements which enter into the science and art of communication by wires, and for this frank exposition everyone interested in the economic features of telephone development is indebted.

The Bell telephone system as a whole comprises 161,452 miles of pole lines and 1,732,039 miles of wire. The daily average of toll connections for 1908 were 463,021, or a total for the year of about 149,000,000. There are over 5,000 exchanges operating 3,467,000 miles of wires on poles and buildings; 4,625,000 miles of wire underground, and 6,540 miles of submarine wire. The estimated number of exchange connections daily in the United States is about 18,500,000, making a total for the year of nearly six billion.

The American Telephone and Telegraph Company is primarily a holding company, holding stocks of associated operating and manufacturing companies throughout the United States and Canada. As an operating company it owns and operates the long-distance lines connecting all the systems of the associated operating companies with each other. The co-ordinated Bell system telephonically interconnects about 4,000,000 subscribers, and any one of these can talk with the other within the carrying power of the voice over wires, the only exception being that the Pacific Coast and Middle Rocky Mountain region are not yet connected.

The fundamental and preponderating element in the Bell system is uniformity and standardization of equipment making for universality of service. Without the extraordinary resources of the central holding company and the centralization of administration it would be impossible to build up this wonderful system, which represents continuous development and which has afforded unlimited opportunity for improvement.

So far has the practice of telephony advanced that today in all of the large centres and in nearly all of the smaller places the telephone exchange is located in a house of its own, equipped with fireproof and weatherproof appurtenances, and in every direction the installation is a permanent thing, the only provision for change being that required to take care of ordinary deterioration and a wise policy of replacement where invention and development make this expedient.

Of the total mileage of exchange wires, over fifty-seven per cent is underground. Of the total value eighty-four per cent is copper and sixteen per cent iron. Of toll wires ninety-one per cent is copper and only nine per cent iron. All the subways and pole lines are built, with few exceptions, under franchises which are actually or in effect permanent; the larger lines for a considerable part are built over rights-of-way actually owned by the companies.

The total earnings for the year were $140,016,400; total expenses, $90,042,400; dividends to the amount of $21,338,100 were distributed among 26,370 shareholders, with an average holding of sixty each; 26,213 of these shareholders hold less than 1,000 shares apiece, while 153 shareholders hold from 1,000 to 10,000 each. There are only four shareholders holding over 10,000 shares apiece.

MEDICAL IONIZATION.

On another page of this issue a brief abstract is given of a paper presented by Dr. Finzi before the Æsculapian Society, at London, England.

We are all aware of the fact that there have been charlatans in many sections of this country and abroad who preyed upon the susceptibilities of neurasthenics and neurotics, exploiting remarkable cures by means of galvanic currents, massage through the use of electrical vibrators, and there are still some who indulge in unprofessional and dangerous practices with high-potential static machines and electric light of various colors. The practices of these are becoming more and more curtailed and the establishment of electrotherapeutics is being brought gradually to a high plane of development. Under the guidance of such men as Dr. Finzi, Professor Leduc, Mr. Deane Butcher and many painstaking workers in our own country, practical results are being secured.

Dr. Finzi's paper deals directly with medical ionization and its application in the cataphoretic administration of soporific drugs and for producing local anesthesia. His explanation of the theory of ionization may not be as complete as some of those who have made a special study of this phenomena may require, but his illustrations are homely and are such as can be well understood by those who are in need of instructions along these lines.

It is with his postulates concerning the technique of the subject and his statement of results that we are especially concerned. He frankly admits the limitation of the practice, but hopefully points out the possibilities which exist in this direction. His record of results is particularly worthy of consideration, and the doctor is to be congratulated upon his exposition. His work is worthy of emulation. But—only by those who have had the training and can work under the guidance of such a specialist as he.

Joint Conference of the Four National Engineering Societies.

A joint conference of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and American Institute of Mining Engineers to discuss the conservation of natural resources was held at the Engineering Societies Building, New York city, on March 24, James Douglass presiding.

A paper was read by a representative from each society on different specific features of this important subject. There was no discussion, owing to lack of time. Reports of the papers follow:

CONSERVATION OF WATER.

This paper was delivered by John R. Freeman, of the American Society of Civil Engineers. At the outset of his paper, Mr. Freeman discussed the effects of lumbering on stream flow, and while approving the beneficial effects of forest conservation he strongly deprecated the alarmist reports of some of the non-technical speakers and writers. He contended that sprout land was nearly as good as timber land for promoting stream flow, and that this fact was amply borne out and proved by actual measurements of the daily flow of the Merrimac River over a long period; hence, the cutting out of scattered merchantable spruce, hemlock, balsam or pine from among the large hardwood growth could make no very material change in the melting of the snow or in the rapidity with which the rainfall reaches the river. Forest fires, however, are more serious and should be prevented at all costs.

The author then entered a strong plea for stream-flow measurements of precision by which the commercial value of waterfalls and reservoir sites could be more accurately estimated. He suggested that this be undertaken on a large scale by the national government, and that the hydrographic branch of the United States Geological Survey, a department which has already done some good work in this connection, and for the members of which he had unstinted admiration and praise, be given a more generous money appropriation to further this work.

The conservation of water for power development was the next point touched on. The author was frankly optimistic as to future prospects for the hydraulic, and especially the hydroelectric engineer. The chief recent development, he pointed out, was the substitution of single plants operating with high heads for the smaller scattered units with too great a subdivision of the fall. Plants of this latter nature have been in existence as long as sixty-five years at Lawrence, Mass., and for somewhat less periods at Holyoke and other manufacturing centres in New England, and it was to the utilization of the waterpower at these places that most of their commercial prosperity was due. The plants were remarkably efficient, even judged by modern standards, and most, if not practically all, of the available power has been successfully harnessed. Other projected and more or less completed plants had failed. The fault of all these early projects was not conservation of power but of capital. They cost too much, needlessly.

Marketability of the power utilized was also a factor too often ignored. Hydroelectric plants, Mr. Freeman averred, would do much toward the utilization of waterpower situated in out-of-the-way places where it would not be of much use otherwise, but it would not be wise to overestimate such possibilities. Processes for the manufacture of nitrogenous fertilizer from the air by means of hydroelectric power, the use of the electric furnace in the manufacture of high-grade tool steels and other products, and many other electrochemical processes are being developed, but as yet are only in their infancy. These, in the future, would provide for some of the electrical output. In or near populated districts electric-power transmission furnishes an immediate market for electricity for light and power purposes.

The author went on to recommend that each state should collect the facts regarding the notable opportunities for power development within its borders, survey the important ones in detail, and prepare outline plans of cost of plant and the power available throughout the year, this latter information to be obtained by cooperation with the hydrographic branch of the National Government. From such an inventory the most beneficial means of conservation of waterpower throughout the separate states could be easily devised.

Other points touched on in this instructive paper were conservation of the purity of water courses, conservation for irrigation, navigation and scenic values.

CONSERVATION BY LEGISLATION.

Prof. R. W. Raymond, secretary of the American Institute of Mining Engineers, read a forceful and suggestive paper on "Conservation by Legislation." He sounded the keynote of the whole subject when he said that "if any real or supposed evil can be cured by enlightening the public mind, it is folly to try to cure it by legislation in advance of such enlightenment." This was amply illustrated by a reference to the hasty, ill-advised and destructive laws of New York state on the subject of forest conservation, which, while they absolutely forbade any cutting of timber and consequent exercise of the forester's art, yet directly encouraged incendiarism by permitting the removal of fallen trees and burnt timber. Hasty legislation, Dr. Raymond pointed out, was often worse than no legislation at all, and, as typically instanced by the previous horrible example, often served to have exactly the opposite effect as that for which it was intended. True conservation, the author said, lies in the diminution, not of use, but of waste. As regards mineral resources, for example, the error of the pioneer miners was not that they worked prematurely and imperfectly, but that they too often left their low-grade ores, slags and tailings in such positions as to be unavailable for retreatment by their successors.

Regarding action by the Federal Government, the author deprecated any increase of its present sphere of operations, and suggested that the matter should rather be taken up by the several states. The record of Congress in the administration of the District of Columbia, where there was absolutely no recent mining law of any sort, and in Alaska, where the Indians were threatened with starvation through a lack of regulation of the salmon fisheries, etc., was sufficient indication of failure of the Federal Government to deal competently in connection with our natural resources of the public domain. The first step toward the conservation of anything is an inventory of it; and until the government of the United States could show itself competent to perform this simple duty as to the property explicitly put in its hand the author did not think it could wisely be entrusted with matters not clearly within its sphere. It was the duty of American mining engineers to urge upon Congress the survey of the public mineral lands, and the enactment of a statute making the simple and reasonable requirement that notices of location shall be

filed in a United States land office within a certain period after the act of location.

THE WASTE OF OUR NATURAL RESOURCES BY FIRE.

Charles Whiting Baker, of the American Society of Mechanical Engineers, followed with this paper, of which the following is an abstract:

Statistics recently collected by the United States Geological Survey show that the fire loss of the United States in the year 1907 was $215,000,000. The reliability of these figures is indicated by the fact that they practically agree with similar statistics for many years collected by the National Board of Fire Underwriters. This vast fire loss was caused by fires in 165,250 buildings, and the average loss on building and contents in each fire was $1,667. In these fires 1,450 persons were killed and 5,650 were injured. If all the buildings in which fire occurred in 1907 were brought close together on both sides of a city street, the average frontage allotted to each building being only 65 feet, the street would extend all the way from New York to Chicago. We are burning up every year in the United States such a street of buildings a thousand miles in length. Every thousand feet along that street of fire-swept ruins one passes the wreck of a building from which an injured person was rescued, and every three-quarters of a mile there is a building in which someone suffered death from the flames. That this vast destruction is not necessary is proved by the experience of European countries. The annual fire loss of the United States represents a per capita tax of $250 on every man, woman and child. The annual fire loss per capita in Europe is only a small fraction of this. In Italy it is only twelve cents per capita; in Austria, France and Switzerland it is about thirty cents; in Germany, fifty cents.

It is true that under certain conditions and for certain places wooden buildings are justified on the score of economy, notwithstanding the fire risk they involve; but the growing scarcity and increasing cost of lumber will soon compel us to adopt stone and brick and concrete for our structures and discard wood as Europe was compelled to do long ago. Our cities particularly must be rebuilt with fire-resisting structures, as nearly all the present structures in American cities are a standing invitation to conflagration.

Referring to the destruction wrought by forest fires, Mr. Baker said that effective laws and effective organizations to prevent such fires are essential before any effective work for forest preservation and restoration can be accomplished. It would be foolish to invest great sums in lands bearing valuable timber when a forest fire may at any time make the investment a total loss. The increasing value of timber lands, in fact, tends to cause their owners to cut the timber rather than risk its loss by fire.

ELECTRICITY AND THE CONSERVATION OF ENERGY.

Lewis B. Stillwell, of the American Institute of Electrical Engineers, concluded with this valuable paper. Mr. Stillwell illustrated the function of electricity in the conservation of power resources by interesting figures showing results accomplished in three typical cases, namely, the plants of the Niagara Falls Power Company, the Northeast Coast Power System at Newcastle-upon-Tyne, and the plants of the Interborough Rapid Transit Company of New York.

He stated that the output of the Niagara Falls Power Company's plants during 1908 was 560,000,000 kilowatt-hours, which was equivalent to a saving of more than 1,000,000 tons of coal per annum.

The Northeast Coast Power System was used to illustrate the economy resulting from substitution of large steam-driven power plants with electric distribution for industrial purposes in place of the large number of small steam plants previously used by the various industries supplied. The plants of this company in operation and in course of construction aggregate 136,600 horsepower. Every shipyard on the north bank of the Tyne is purchasing practically all of its power supply in the form of electricity, and in addition to this the system is responsible for the supply of current to eighty miles of electrified railway, four tramway systems, lighting in towns having populations aggregating over 700,000, motive power to the extent of 85,000 horsepower, and electrochemical works of over 12,000 horsepower.

It was pointed out that this system is supplying electricity even to coal mines in Northumberland and Durham districts, and that when the application of electricity to coal mines in this district is complete the economies effected will render available for outside sale over one-and-three-quarter million tons of coal per annum.

The output of the power houses of the Interborough Rapid Transit Company in the year 1908 was 409,000,000 kilowatt-hours. From tests made on the Manhattan Elevated Railway prior and subsequent to the adoption of electricity it was calculated that the saving of coal in the case of the Interborough company as compared with the amount which would be consumed if locomotives were used for equivalent service is approximately 1,000,000 tons per annum.

Basing calculations upon the most recent census statistics available it is estimated that 25,000,000 horsepower steam and hydraulic are installed for industrial purposes. The aggregate power used by our railways on a basis comparable with industrial service is estimated to be approximately 4,000,000 horsepower. Definite figures in regard to the aggregate waterpower that might be developed at practicable cost under present conditions are not available. The report of the Inland Waterways Commission for the recent general conservation conference in Washington estimates that "the amount available at cost comparable with steam operation is 37,000,000 horsepower," which "exceeds our entire mechanical power now in use, and would operate every mill, drive every spindle, propel every train and boat and light every city, town and village in the country."

Mr. Stillwell said that whatever may be the aggregate amount which can ultimately be utilized, certain guiding facts are obvious and cannot be controverted. Among these are: (1) Under average conditions every hydraulic horsepower utilized for industrial purposes in ten-hour service saves at least seven-and-one-half net tons of coal per annum. (2) Present knowledge does not permit us to secure from coal more than about ten per cent of its potential power. (3) Electricity enables us to substitute a few and comparatively efficient steam plants for large numbers of small and relatively wasteful installations, thus effecting important economies not only in fuel consumption but also in other directions. It also enables us to transmit and utilize in available markets a fair proportion of the aggregate waterpower of our streams.

In conclusion the author gave some interesting data on inland waterways and said that an indirect tax on waterpower to pay for these, he considered of double wisdom from an economical standpoint.

Electrical Equipment of a Modern Paint Factory.

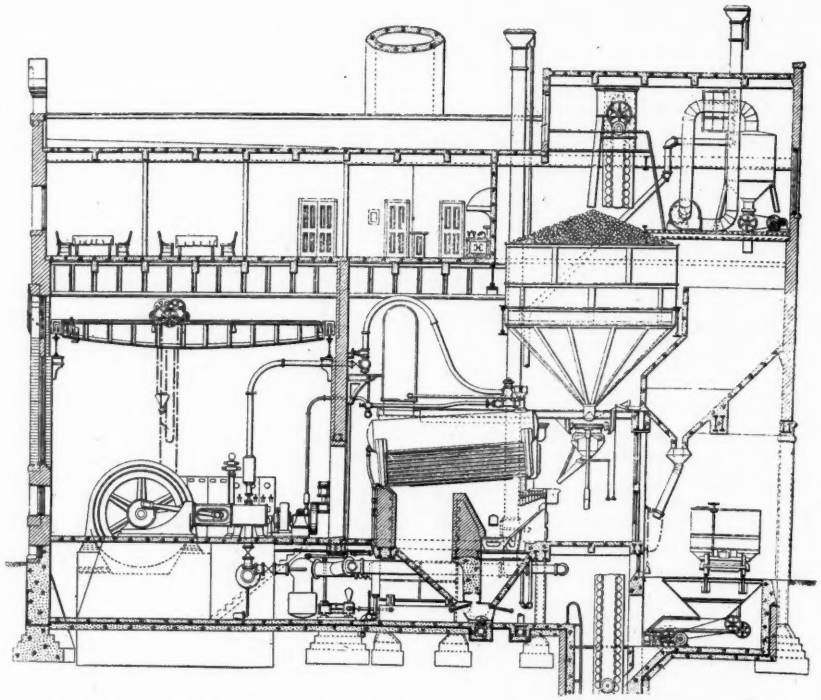
There was put in operation recently in Chicago a new manufacturing plant that embodies a number of features of interest to the electrical engineer. Among these is included a very complete centralized power house, a highly developed system of determining the power and lighting supply furnished to each department, and a novel system of electric-machine driving by means of alternating-current motors exclusively throughout the establishment.

The plant referred to is the new paint works of the Heath & Milligan Manufacturing Company, situated between Canal and Seward streets, near West Eighteenth Street. This company is one of the oldest paint manufacturers in the West. A few years ago it met with financial reverses caused largely by an almost complete destruction of the factory by fire. The company has now been reorganized with abundant capital and is pushing the completion of the new factory buildings, most of which are already in active service. These buildings are as follows: A, main manufacturing building; B, warehouse; C, dry-color works; D, power house; and E, oil house. Buildings B and C are not yet built; the foundations for the former are already in place, and work on the latter has just begun.

All the buildings are of fireproof construction throughout. The structural framework is of steel, and the flooring of reinforced concrete; the side walls are independently built of brick. All stairways are of concrete and entirely inclosed; elevators and barrel hoists are similarly inclosed by fire walls. A complete sprinkler system is connected with a set of pressure tanks supplied by a large Underwriters' fire pump. The buildings are subdivided into sections by fire walls.

The power house is in the southwest corner of the plat; its ground dimensions are eighty by 100 feet, and its height sixty feet from the basement floor to the roof line. The engine room is thirty-seven feet wide and spanned by a fifteen-ton, hand-operated traveling crane. The room is lined on all sides with white enameled brick and has many high windows on the west; parallel with it is the boiler room. Beneath both is an unbroken basement, containing most of the auxiliaries and piping. In the upper part of this building are a kitchen and dining room and other facilities for the comfort and convenience of the employes of the plant.

In the boiler room there are at present installed four Heine water-tube boilers rated at 300 horsepower each and arranged in two batteries. Reserve space is arranged for another battery of similar size. The boilers are fed by Roney mechanical stokers. Instead of providing coal bunkers directly above the boilers, there is installed a single steel bunker of 160 tons capacity, located at the south end of the boiler room. This arrangement eliminates trouble from spontaneous combustion in unused bunkers and permits some advantages in the coal handling. As shown in the cross-section of the power house, the coal is received from the cars into a track hopper that discharges through a motor-driven coal

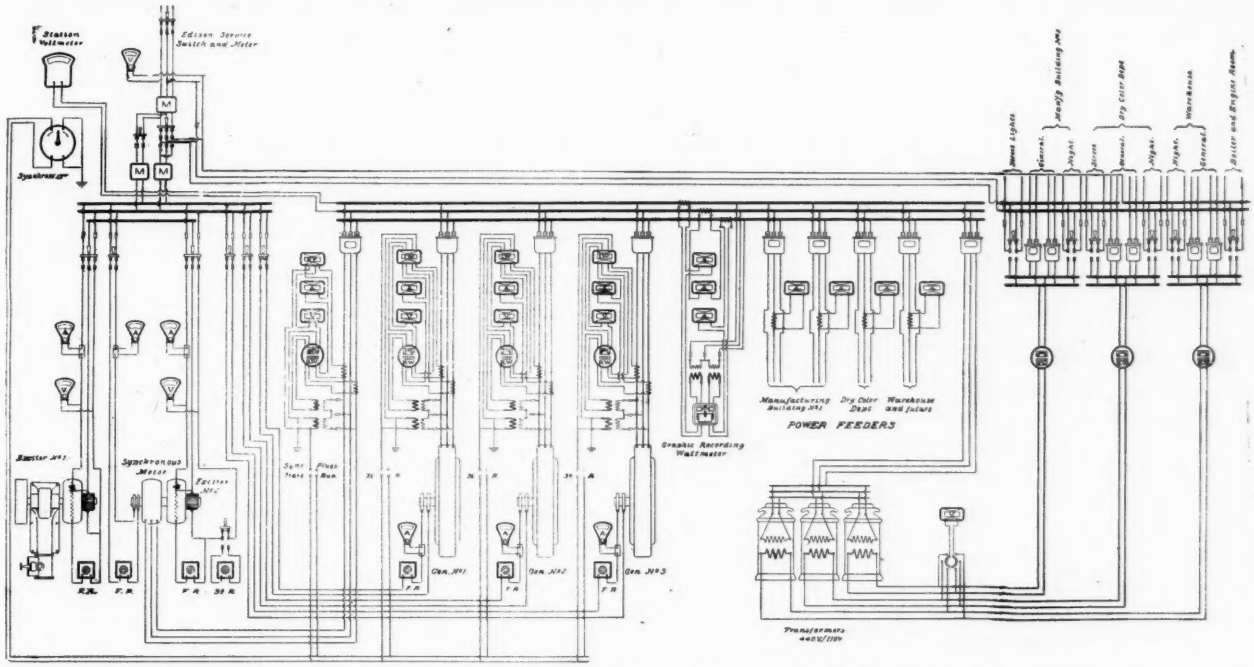


CROSS-SECTION OF POWER HOUSE, HEATH & MILLIGAN PAINT WORKS.

SOUTH END OF ENGINE ROOM, HEATH & MILLIGAN PAINT WORKS.

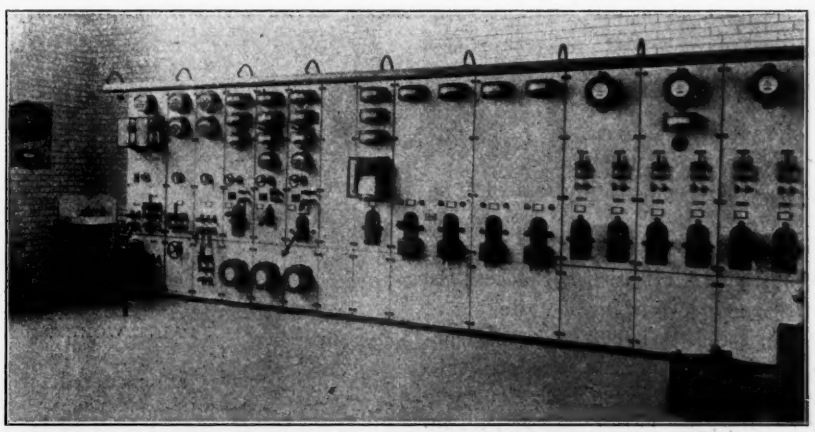
crusher into a vertical bucket conveyor which raises it into the bunker. From this it is withdrawn as needed into a hopper provided with an automatic scale and movable along an overhead track to the front of any of the boilers, where this hopper is emptied into the stoker hopper. Thus an accurate record is kept of the weight of the coal as it is fired.

Ashes are withdrawn from the hopper-shaped ash-pits by means of a pneumatic suction outfit that carries them up through an eight-inch pipe to a dust separator and concrete storage bin near the coal bunker. From this they can be discharged into cars or wagons. The vertical portion of the suction pipe is some sixty feet high. The suction is produced by a Sturtevant three-foot exhaust fan that is motor-driven. The ash-handling outfit was installed by the Economic Engineering Company, of Chicago. A concrete chimney 195 feet high and 7.5 feet inside diameter was built by the Weber Company, of Chicago, on a separate foundation just north of the building.



WIRING DIAGRAM OF MAIN SWITCHBOARD, HEATH & MILLIGAN PAINT WORKS.

In the engine room there are two main generating units of 150 and 400 kilowatts, respectively. The prime movers are cross-compound Fitchburg engines, the smaller of which has cylinders twelve and eighteen by thirty-six inches and the larger eighteen and thirty by thirty-six inches. Provision has been made for a third unit, to be a duplicate of the 400-kilowatt unit. Each engine runs at 120 revolutions per minute and is direct-connected to its generator. The generators are sixty-cycle, 440-volt, three-phase, revolving-field machines, furnished by the Western Electric Company. There are installed two thirty-kilowatt, 110-volt exciters. One is driven by a high-speed Ball engine and the other by a synchronous motor that can be connected to the three-phase busbars. Each of the exciters is capable of supplying the excitation for all the generators and of furnishing the lighting current required at night.



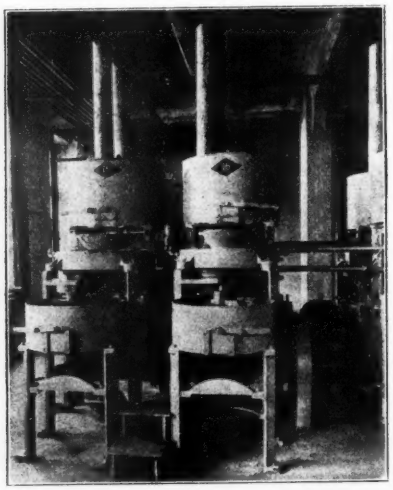
MAIN SWITCHBOARD IN POWER HOUSE, HEATH & MILLIGAN PAINT WORKS.

There are also in the engine room two Westinghouse air compressors of the locomotive type, each capable of furnishing 125 cubic feet of air a minute. The compressed air is used chiefly for forcing linseed oil and other liquids through piping in the manufacturing and dry-color buildings. The air is stored in two receiver tanks in the basement of the power house. Since there is considerable use for the exhaust steam from the engines and pumps for heating the buildings and heating the feed water, no condensers are provided. The feed-water heater and other auxiliaries are located in the basement. Among these are two boiler-feed pumps, a hot-water pump for handling the hot water used in the manufacturing processes and in lavatories, a vacuum pump for the heating system and the Underwriters' fire pump.

Electrical connections from the generators to the switchboard are made by means of lead-covered cables strung along the basement ceiling. The switchboard has twelve panels and an auxiliary hinged synchronizing panel. A good general view and a diagram of connections are

shown in accompanying illustrations. At the left end is a panel controlling connections with the Commonwealth Edison Company's direct-current lines for lighting service at night or other times that the plant might be completely shut down. In emergencies the Edison service could be used to run the motor-driven exciter inverted, so that the synchronous motor could be run as a generator supplying the three-phase busbars with a limited amount of power. Recording wattmeters are provided for recording the total Edison input and also any used for power, and one for recording the output of the exciters that may be used for lighting when the alternators are shut down.

Next are two panels for the direct-current exciters, each equipped with ammeter, voltmeter, field rheostat and the necessary switches. A separate panel controls the synchronous motor for one of the exciters. This motor, as well as the main generators, is provided with Westinghouse polyphase recording wattmeters and oil switches. This panel and the generator panels are further provided with synchronizing taps, field rheostats, ammeters and switches, and Wagner horizontal edgewise indicating main ammeters, voltmeters and wattmeters. A reserve panel is left for a future generator, No. 3.



A GROUP OF MOTOR-DRIVEN GRINDING MILLS, HEATH & MILLIGAN PAINT WORKS.

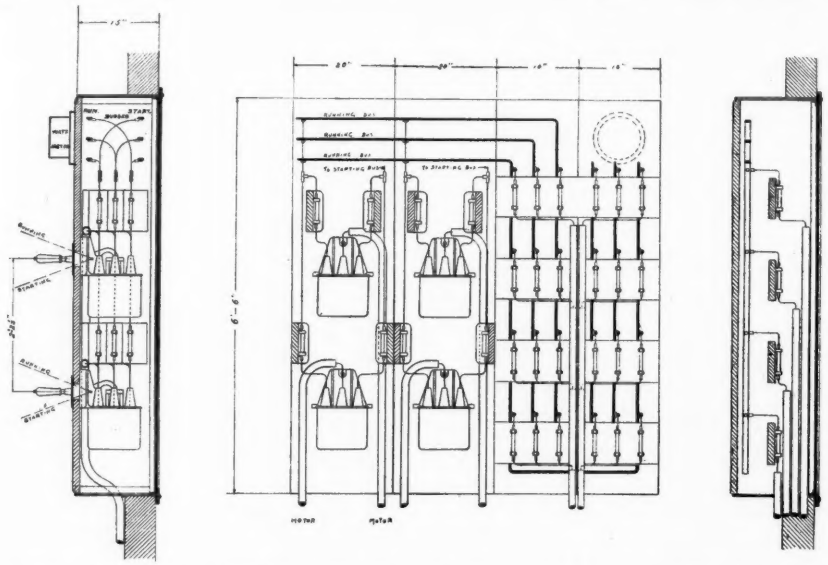
A Westinghouse graphic recording wattmeter measures the total station three-phase output. Above it is a set of three ammeters connected by current transformers to the main busbars; below it is the switch for the lighting transformers. The power feeders, of which there are four, are controlled from two adjacent panels by means of oil circuit-breaker switches.

The alternating current used in lighting is stepped down to 110 volts by means of three Westinghouse transformers of thirty kilowatts capacity. The last three panels control the lighting circuits, of which there are twelve. Half of these are for general lighting in the main buildings and are fed from the transformers through recording wattmeters and oil switches. The night circuits are fed either from the transformers or from the direct-current buses, as described above.

From the switchboard the wiring to the various departments is entirely in conduits, most of which, with the steam, air and hot-water piping, pass through a subway from the power-house basement underneath an alleyway to the main and dry-color manufacturing buildings. The conduits are run in the concrete floors and walls to distributing centres in each room. The cut-out panels for the lighting circuits are inclosed and separate from the motor-control boards.

Most of the motors are operated from motor-control boards, of which a typical diagram and a front view are shown in accompanying illustrations. Since all the motors are induction motors, running at constant speed, their control is very simple, provision for starting at reduced voltage being all that is required. The supply circuit, after passing through an integrating watt-hour meter to record the power consumption of that room, terminates in a set of 440-volt running buses common to the entire board. A separate set of 220-volt starting buses is provided, fed by an auto-transformer, not shown.

Each motor has an oil switch on the board, with merely the handle projecting through the front of the board. The handle has three positions, the middle one being the dead point, the lower the starting position, where the motor terminals are connected to the starting buses and the upper the running position, where the terminals are connected to the running buses. In starting, the handle is merely thrown down till the motor is practically at normal speed, then the handle is quickly thrown up to the running position. These control boards are inclosed and set near the wall to take up but little room.



WIRING OF MOTOR-CONTROL PANEL BOARDS, HEATH & MILLIGAN PAINT WORKS.

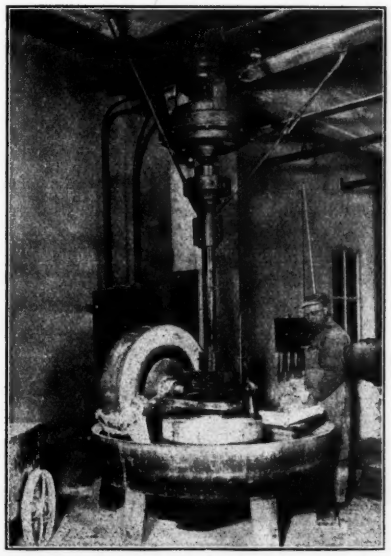
Most of the motors drive groups of mixing and grinding mills that run at fairly low speed. As shown in one illustration, the motors are mounted on the floor between the mills and drive the latter through a train of spur or bevel gearing or a combination thereof. As a rule, a motor drives four mills, each of which is connected to the group shaft by a friction clutch. In the mixing and grinding mills each tank contains a sweeping arm for stirring and mixing the contents. A considerable number of hori-

TYPICAL MOTOR-CONTROL BOARD, HEATH & MILLIGAN PAINT WORKS.

zontal revolving cylinders, known as breakers, are grouped on steel galleries. These likewise are driven by spur and bevel gears.

Another type of machine used extensively is a modified Chili mill known as a chaser. As shown in an accompanying illustration, these machines have individual-motor drive with a vertical five-horsepower motor mounted near the ceiling. These motors run at 1,200 revolutions per minute and drive the chaser at sixteen revolutions per minute. The chasers are used chiefly for the first grinding of the dry materials with oil; thus they form the initial step in the preparation of white lead and mixed paints, as well as in the mixing of putty.

In the preparation of mixed paints the



MOTOR-DRIVEN CHASER MILL, HEATH & MILLIGAN PAINT WORKS.

thick lead and oil mixture from the chasers is first thinned with more oil in mixing mills; it then passes through thirty-inch grinding mills into the breaker tanks, and from these it goes through tinting tanks into the cans ready for shipment. A similar procedure is followed in the preparation of pure white lead except that it does not pass through any tinting tanks and is usually shipped in kegs and barrels. As equipped at present, the manufacturing department has about forty thirty-inch grinding mills, forty-four similar twenty-inch mills, about fifty tinting tanks, twelve breaking tanks and a very large number of mixing tanks. The dry-color department, when completed, will have a large equipment of crushers, grinders and mixers, which will require a large number of motors. At present there are seventy-two motors, ranging from three to thirty horsepower, installed throughout the plant, most of which were furnished by the Western Electric Company. There are also two barrel elevators run by thirty-horsepower motors, and an alternating-current general freight elevator.

The power house and the engineering features of the plant in general were designed by W. A. Blonck, of Chicago, consulting engineer, and the installation was carried out under his supervision. The power house and mechanical and electrical operation of the plant are in charge of Albert Hamble, chief engineer of the Heath & Milligan Manufacturing Company. From these two gentlemen were obtained the data on which this article is based.

Detroit Street Railway.

The Street Railway Commission of Detroit, appointed by the mayor to consider a plan of settlement under existing conditions, has recommended that eight tickets be sold for twenty-five cents, with five-cent fare for single cash rates. If necessary to operate profitably, seven tickets for a quarter may be provided. Other features are the renewal of franchises until 1924, when all franchises expire together; a non-partisan municipal railway commission appointed by the mayor to supervise schedules, construction, rates, etc., under veto power of the City Council; physical valuation of the Detroit United Railway property, and six per cent guarantee on valuation. All profits over six per cent are to go to the city as sinking fund for eventual purchases of the system by the city.

Public Service Investment Company.

Stone & Webster, whose twenty-eight operating companies have outstanding over $113,000,000 capitalization, have formed a holding company known as the Public Service Investment Company, capitalized for $1,000,000 six per cent cumulative preferred and $2,000,000 common stock. It will take over as its original investment $2,175,000 dividend-paying stocks of seven of the Stone & Webster operating companies. The new securities are being offered in blocks of ten shares of preferred and four shares of common for $950.

The new company starts with gross earnings from dividends on stocks owned of $104,750, sufficient to pay the six per cent on the preferred and two per cent on the common.

THE INDUSTRIAL APPLICATION OF THE ELECTRIC MOTOR IN STEEL MILLS.[1]

BY B. R. SHOVER.

I.

INTRODUCTION AND HISTORICAL.

Twenty years ago electricity, except for lighting purposes, was virtually unknown to the iron and steel industries, while today in all of the steel works in this country it is used as a motive power for most of the auxiliary machinery, from the ore docks to the loading beds. The electric drive is utilized in ore unloaders, ore bridges, car dumpers, bin-filling cars, scale larries, blast-furnace skips, hot-metal mixers, electric cranes of all sizes and descriptions, open-hearth charging machines, ingot buggies, gas producers, roller tables, lifting tables, transfers, hot-bed apparatus—in short, a multitude of machines too numerous to mention here. This development has been such that it would probably be no exaggeration to say that the steel industry in this country would never have reached its present proportions without the use of electric motors.

Development of the Direct-Current Motor.—The first application of electric power to the steel-mill industry was by means of the direct-current motor. In an historical way the following remarks may be of interest, but for the absolute accuracy of the dates given the author does not wish to be held entirely responsible, though all possible care has been taken to verify them.

In 1882 the first electrical installation in any steel plant in the United States was made at the works of the Edgar Thomson Steel Company at Bessemer, Pa. It consisted of a two-light Brush arc machine. In 1889 an electric traveling crane was installed at the works of the Pencoyd Steel Company near Philadelphia.

In 1891 a fifty-horsepower, 250-volt, compound-wound generator was installed in the Edgar Thomson Steel Company. This machine was used to supply current for an experimental crane over the heating furnaces at the blooming mill. In February, 1893, the first motor-driven roller table was put in operation at the Homestead Works of the Carnegie Steel Company. On February 9, 1895, the first mill having all its roller tables motor-

1. Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, New York, March 12, 1909. The full title of the paper is "The Industrial Application of the Electric Motor, as Illustrated in the Gary Plant of the Indiana Steel Company." The author is electrical engineer of that company.

operated was started by the Ohio Steel Company of Youngstown, Ohio.

In the early days belt-type street-railway motors rewound for 250 volts were all that were available, but the severe service to which this apparatus was subjected led the manufacturers to strengthen it and to design new motors to meet the requirements; so that the steel industries both assisted in and profited by the general improvement of electrical machinery. One result of these requirements has been the development of the so-called mill motor. This motor has a heavy cast-steel frame, a large armature shaft which can be replaced without disturbing the winding, the minimum number of bolts, ample air-gap and fireproof winding throughout. So successful has this type of motor proved that it is now being used almost exclusively, even on traveling cranes, regardless of the fact that the entire crane and runway must be made much heavier in order to carry the additional weight.

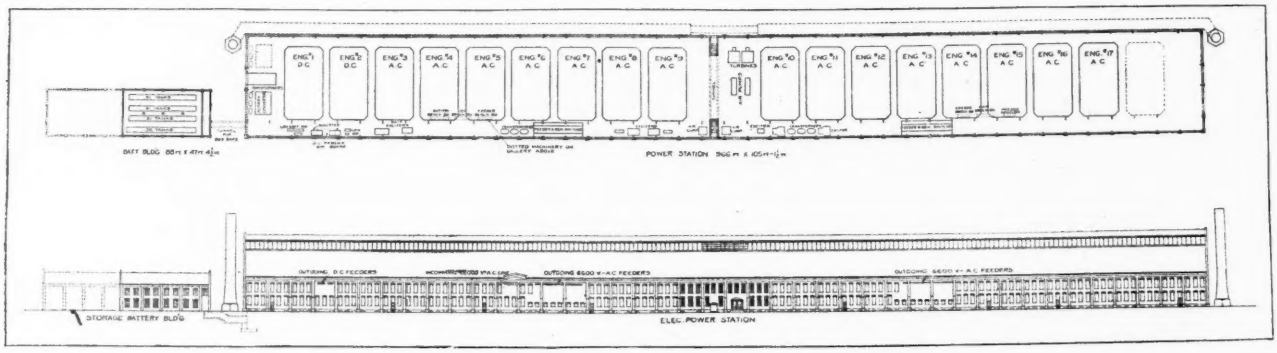


FIG. 1.—PLAN AND ELEVATION OF THE POWER STATIONS 2 AND 3.

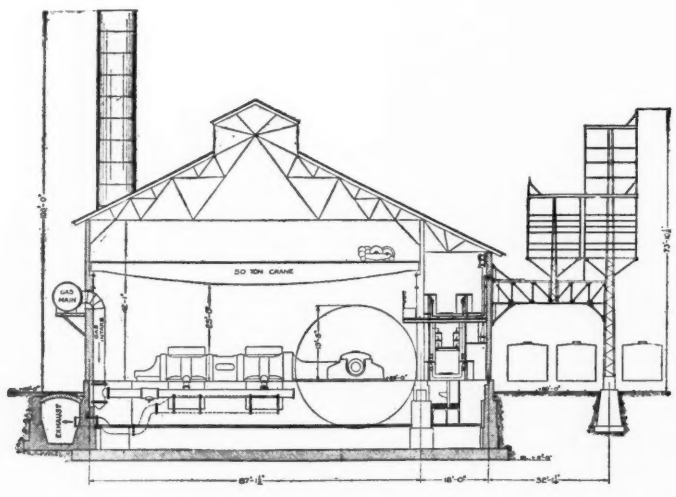


FIG. 2.—CROSS-SECTION OF ELECTRIC POWER STATIONS.

In order to appreciate the importance of such apparatus to the steel manufacturer it must be understood that the real efficiency of any machinery used in this industry is indicated by the amount of steel shipped per day or year. A motor of higher engineering efficiency that causes shutdowns, and consequent decrease of profit, is not nearly so efficient as a motor that operates twenty-four hours a day and 365 days a year, if necessary, practically without stopping. This feature is considered so important that in one plant the superintendent of the electrical department requires a special report from his mill foremen whenever the mill is delayed more than three minutes by changing the armature of a table motor. The steel-works electrical engineer has long since recognized that the mills are built to manufacture steel, and to be successful electrical apparatus must meet the requirements, no matter how severe. To the credit of the engineers be it said that the number of absolute failures to operate any of the apparatus has been very small indeed.

Development of the Alternating-Current Motor.—The coming of the induction motor found the steel mills equipped with direct-current apparatus, but the induction motor is so much better suited for this kind of work that it has gradually worked itself into the field until today it forms a considerable part of the aggregate horsepower used in the steel industry. The following historical notes represent the more important steps in this development.

In 1900 the Joliet works of the Illinois Steel Company installed a 250-volt direct-current synchronous converter operating from a 2,200-volt, three-phase supply, the power being furnished by an independent power company. In 1902 the Pennsylvania Steel Company of Harrisburg, Pa., installed an 11,000-volt transmission system. In 1903 the first induction motor used in the steel industry was installed at the Joliet works of the Illinois Steel Company.

In June, 1904, the South works of the Illinois Steel Company installed a synchronous converter and step-up transformer to operate a 2,200-volt transmission line, and in September of the same year a 4,000-kilowatt power plant, generating at this voltage, was installed. About the same time this voltage was stepped up to 22,000 volts for transmission to the cement works at Buffington, twelve miles away.

In December, 1904, the first installation of 6,600 volts for interworks use was installed by the Lorain Steel Company. This voltage now seems to be the favorite for use in the entire steel industry, as it has been employed in many of the late installations.

The Application of Electric Motors to the Roll Trains.—While the United States has led in the application of electric drive to auxiliary machinery, Europe has pioneered the way in its use for driving roll trains. In the different European steel plants there are today about 230 motors with a normal capacity of 19,000 horsepower and a maximum capacity of 41,000 horsepower used for electric drive of non-reversing roll trains. In

addition, one noteworthy installation is that of a 10,500-horsepower reversing outfit at the Hildegardehütte mine.

The first application of motors for driving roll trains in this country was made at the Edgar Thomson steel works of the Carnegie Steel Company, where two three-high roll trains for rolling small rails were operated by 1,500-horsepower, 220-volt, direct-current motors. The speed of these motors is varied by shunt-field resistance from 100 to 125 revolutions per minute. The success obtained by this installation has stimulated the installation of similar outfits elsewhere.

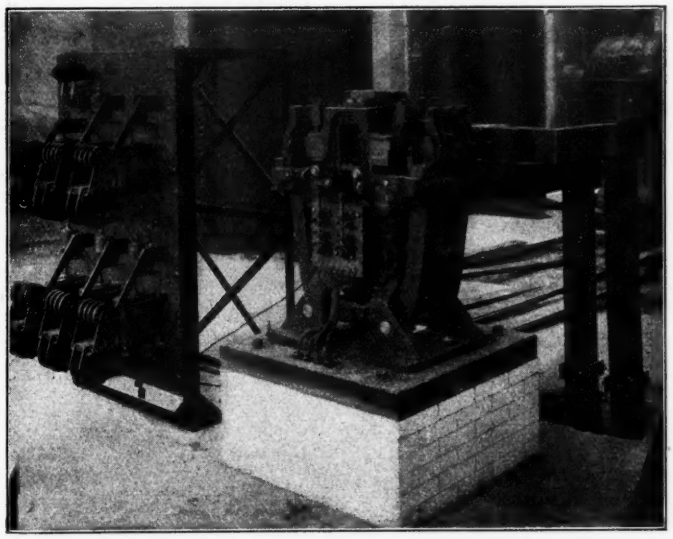


FIG. 3.—10,000-AMPERE REMOTE-CONTROL SWITCH.

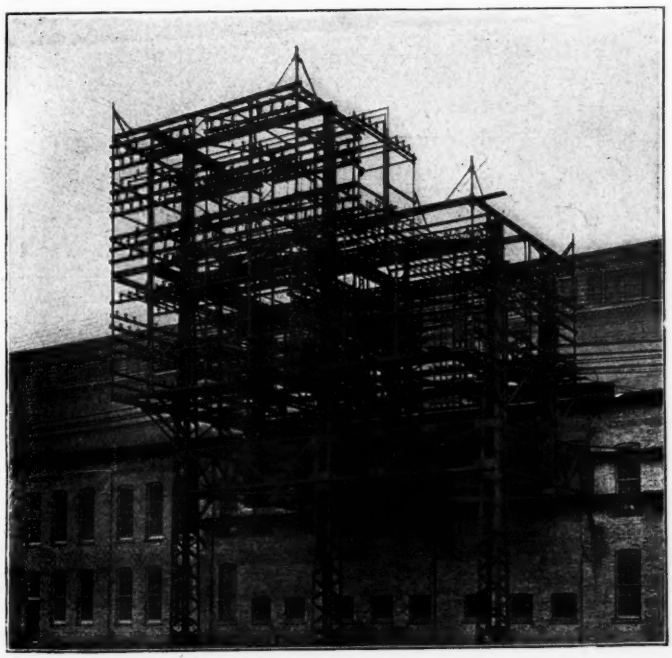


FIG. 4.—ONE OF THE SPECIAL ALTERNATING-CURRENT WIRING TOWERS.

In June, 1907, the Illinois Steel Company put in the first and only reversing-mill drive that has been installed in this country. The mill, a thirty-inch universal plate, is direct-coupled to two 2,000-horsepower, 150 - maximum-revolutions-per-minute, 575-volt, shunt-wound motors mounted on one shaft; 2,200-volt, three-phase, twenty-five-cycle, alternating-current power being used to drive a motor-generator set consisting of a 1,300-horsepower motor and a 600-volt, direct-current generator. On the same shaft is mounted a flywheel 100 tons in weight, thirteen feet two inches in diameter, the whole making 375 synchronous revolutions per minute.

In August, 1907, at the same works, a rail mill for rolling small rails similar to those rolled at the Edgar Thomson Steel Company was put in operation. The roll trains here, however, were driven by 2,200-volt concatenated motors. The primary motor has a capacity of 1,200 horsepower, and runs at 120 revolutions per minute; the secondary motor is 600 horsepower, and runs at eighty-two revolutions per minute. In ordinary operation the resistance in the secondary motor is so adjusted that the combined speed of the two varies between sixty and eighty revolutions per minute, according to the character of material rolled.

The Use of a Storage Battery.—Another electrical device which has only recently been used in the steel industry is the storage battery. On March 27, 1904, the first installation of this nature was made at the Ohio works of the Carnegie Steel Company, Youngstown, Ohio. This battery had a capacity of 1,600 ampere-hours and was used for regulating the load on a direct-current station. On April 29, 1905, the capacity of this battery was increased fifty per cent. The success of this installation was so marked that batteries of considerable size were installed at the Lukens Iron and Steel Company, Coatesville, Pa. Two large batteries were also installed at the Illinois Steel Company, South Chicago, one at the Carrie furnaces of the Carnegie Steel Company, Rankin, Pa., and the largest of all at the Edgar Thomson works of the Carnegie Steel Company, Bessemer, Pa.

The Use of a Synchronous Converter and Booster Regulator, with Storage Battery.—In 1906 an additional feature in connection with the battery was contracted for by the Ohio works. This was a combined converter and booster to be used for regulating the variable load from an alternating-current plant then being designed. This outfit, however, has not yet been put in operation.

THE GARY PLANT.

Inception.—For several years the United States Steel Corporation had recognized the necessity of supplying the increased demand for its product throughout the West. To give an idea of the rapidity with which the demand for these products had grown, the total product of steel in the United States in 1894 was 4,000,000 tons; in 1895 this product had increased to 6,000,000 tons; in 1900 to 10,000,000, and in 1906 to 23,000,000 tons.

The constantly increasing proportion of

this material used throughout the West necessitated the location of additional manufacturing facilities closer to the point of consumption. As none of the existing plants had ground enough on which to install the required increase, it was decided to build an entirely new plant, to be designed so as to embody all the features that would insure economical production. The site chosen is at the extreme south end of Lake Michigan, about twenty-six miles from the centre of Chicago. It consisted of about 10,000 acres of sand dunes, absolutely uninhabited, and covered by a growth of scrub oak, pine and cactus. The advantages of this location consist of lake transportation, splendid railroad facilities and cheap land.

The governing feature in the design of the plant was economy. To this end the plant was planned so as to get the best possible transportation facilities for the material during its various stages of manufacture throughout the entire works. To add to the enconomy, the design included the use of blast-furnace gas in gas engines, driving electric generators to furnish electric power for use wherever its application was practicable.

In the general design all features were incorporated which had proved satisfactory elsewhere, it being the intention to exploit only the new applications and schemes which were absolutely necessary to the construction of such a works, and thus minimize, as far as possible, experimental apparatus.

With this object in view, it was decided to abolish the use of trolley wires for cranes, scale larries, etc. For traveling apparatus up to and including traveling cranes of fifty tons capacity a two-inch by three-eighths-inch steel strip is used for main conductor. Apparatus of larger capacity uses a sixty-pound rail, while the unloaders and bridges have 100-pound rails, reinforced by heavy copper cable, so as to get carrying capacity sufficient to avoid excessive drop.

The layout of the plant has been so well described in several recent publications that detailed description need not be given here.

Present Condition.—Of the plant as planned, the slip and docks are complete; one-half of the ore yard and its machinery, including the ore bins, is finished; also one group of blast furnaces—of which three are in blast—with its complement of blowing engines and gas-washing plant, and the central pumping station. The pig-casting machines have all been in operation for some time. Four more blast furnaces, with their auxiliary buildings, are about seventy-five per cent completed. The No. 3 electric power station and storage battery are ready for operation; the turbines in No. 2 power station have been in operation since July, 1908, and the remainder of the station is rapidly being completed. One-half of one open-hearth plant is in operation, a second plant is practically complete, and foundations are ready for a third. The entire shop group has been in operation for more than a year. The rail mill has been tried out. Most of the machinery has been installed in the billet mills. The foundations are laid and part of the structural material of the merchant mills is already crected.

In the part of the works now complete there are installed 110 electric traveling cranes with an aggregate lifting capacity of 3,812 tons. The capacity is 22,025 horsepower in direct current and 5,312 horsepower in 440-volt alternating current; 27,000 horsepower in 6,600-volt alternating-current motors have already been operated. About an equal aggregate number of horsepower will be required for the operation of that part of the plant now under construction, and still more for parts which are at present being designed.

ELECTRIC POWER STATION.

For this part of the plant it is intended to use the gas available from eight blast furnaces. On account of the large amount of current, the especially large number of circuits and units, and also to make the operation more reliable, this plant is divided into two sections, which are called power houses No. 2 and No. 3, respectively.

The eight blast furnaces, producing 3,600 tons of pig-iron per day, will give a total of 22,450,000 cubic feet of gas per hour. Thirty per cent, or 6,750,000 cubic feet, of this gas is used for heating stoves; 7.5 per cent, or 1,700,000 cubic feet, is used under the boilers to furnish steam for spare steam engines, pumps and miscellaneous heating; 2.5 per cent, or 600,000 cubic feet, is necessary for operating the gas washers; 12.5 per cent, or 2,800,000 cubic feet, is used by the blast-furnace blowing engines; 2.5 per cent, or 600,000 cubic feet, for auxiliary use in connection with these engines. The remaining forty-five per cent, or 10,000,000 cubic feet, per hour, is available for power purposes. If estimated at ninety British thermal units per cubic foot and

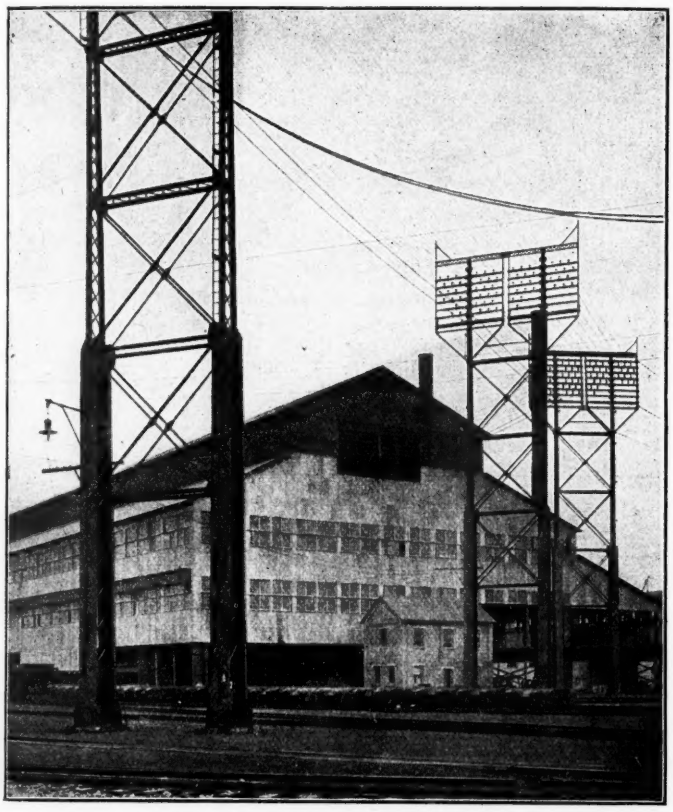


FIG. 5.—STANDARD 75-FOOT STRAIGHT-LINE TOWERS.

10,000 British thermal units per boiler horsepower, this gas is equal to 110,000 boiler horsepower in gas engines.

There are installed in No. 2 and No. 3 electric power stations a total of seventeen gas engines, each rated at 3,000 horsepower, but capable of about fifty per cent overload. It will therefore be seen that approximately only fifty per cent of the available power as calculated will be used in this station. This allotment will make allowance for furnaces out of blast, and for gas shortages due to troubles liable to occur in furnaces during operation.

The electrical equipment of power houses No. 2 and No. 3 comprises fifteen 2,000-kilowatt alternating-current units, two 2,000-kilowatt direct-current units—all driven by gas engines, and also two 2,000 alternating-current turbo units.

The gas engines are horizontal twin tandem, double-acting, running at eighty-three-and-one-third revolutions per minute. The cylinders are forty-four inches in diameter by fifty-four-inch stroke. The floor space occupied by each engine and generator is seventy-four by thirty-nine feet, with total weight of about 1,700,000 pounds. The bedplate weighs over ninety tons. The flywheel is twenty-three feet in diameter and weighs 200,000 pounds.

The two turbines are rated at 2,000 kilowatts each, and were installed primarily for use in the construction of the plant and to furnish power for starting up. It is also expected that they will assist materially in the regulation of the station by taking care, to a certain extent, of the sudden peak loads.

Storage Batteries.—The installation of the storage batteries was for the purpose of minimizing the fluctuation of load on the generating station. They consist of two separate batteries of 125 cells, seventy-three plates per cell, each battery having a rating of 4,320 amperes, with a momentary rating of from two to three times that amount. They are installed in a two-story building located north of the power station, the connection between the two buildings being through a tunnel.

The direct-current regulation is accomplished by means of two 2,500-ampere, thirty-five volt boosters. The motors and generators of this booster are of the interpole type, controlled by a carbon-pile regulator acting through a motor-driven exciter. The alternating-current regulation is accomplished by means of special 2,000-kilowatt split-pole converters. The regulating current for this converter is supplied by a series transformer in the leg of each generator lead. In turn, these transformers are connected to a totalizing transformer of the compensator type which supplies current to a synchronous motor-driven synchronous converter. From the direct-current side of this converter is taken the regulating current for the split-pole converter. A special 10,000-ampere, remote-control switch short-circuits the starting resistance (see Fig. 3).

The generator oil-switches are arranged so that the regulating transformer of each generator is short-circuited when that generator is not in service. Connections are also made so that when stations No. 2 and No. 3 are tied together the battery will regulate on both, but should either tie-switch be thrown out, thus disconnecting the two stations, no regulation is possible on station No. 2, and the current transformers in the legs of the generators in that station are at the same time short-circuited.

The transmission system is in duplicate, each section having sufficient capacity to carry the entire load in case of accident to the other sections. The lines are supported upon a steel-tower construction made exceptionally heavy on account of the great height of the towers and heavy complement of feeders.

Substations.—There are three substations. Substation No. 1 is located in the rail mill and consists of four 500-kilowatt motor-generator sets. These are duplicates of the exciter sets in the power station. This substation normally supplies current for all the direct-current apparatus in the shop group, rail mill, and billet mill. Substations No. 2 and No. 3 each have two units, duplicates of those in substation No. 1. They normally supply current to the ore unloaders and bridges.

The direct-current power furnished from the two 2,000-kilowatt gas-engine-driven units in the power station is used to supply the direct-current motors for the blast furnaces and open-hearth plants. When the mills are not in operation and only the lights and a few cranes are needed, it will be possible to shut down the substation and furnish power direct from the power station. The nature of load is such that a storage battery installed at the substation would be of great advantage in its operation. This battery will probably be installed in the near future.

Transformer Stations.—There are located at various parts of the plant nine installations of transformers for supplying 440-volt, three-phase alternating current. In these stations there are a total of nine 800-kilovolt-ampere, oil-insulated, water-cooled transformers, and twenty-seven 100-kilovolt-ampere, oil-insulated, self-cooling transformers.

[To be continued.]

New England Section, Illuminating Engineering Society.

At the last meeting of the New England Section, Illuminating Engineering Society, held on March 16, a number of committees were appointed in pursuance of the recent plans for creating interest in the local work. Those appointments, together with a brief outline of the duties of the committees, are as follows:

By-Laws (for the revision of the present by-laws)—J. S. Codman, chairman; F. A. Gallagher and W. F. Norton.

Publicity (proper advance notices and reports of meetings to be furnished to the press)—L. D. Gibbs, chairman; R. C. Ware and Walter F. Brastow.

Papers (securing papers and providing programmes for local meetings and co-operation with other sections in such matters)—L. D. Gibbs, chairman; H. M. Daggett, C. A. Learned, A. N. Minty and A. W. Burnham.

Council Proceedings (report on work of general council, suggesting matters that may be discussed and then referred to the council; also other matters pertinent to the subject)—Dr. Louis Bell, chairman; Prof. A. E. Kennelly, R. B. Hussey, N. T. Wilcox and W. W. Cummings.

Membership—H. W. Moses, chairman; F. A. Curry, H. C. Jones, A. T. Sampson and three others to be named.

"Hand-Shake" Committee (members to be present early at monthly meetings to greet others who come, introducing them to each other and stimulating a feeling of good-fellowship)—D. A. Howard, chairman; H. H. Kelly, J. W. Cowles, H. A. Holder, C. O. Baker, Benjamin J. Bean and H. H. Skinner.

Entertainment (arranging for getting together of members who dine in town between office hours and the hour of the section meeting, with a view to selecting some convenient eating place where good-fellowship may be cultivated)—E. C. Kimball, chairman; Fred H. Sargent, William B. King, William McGregor and George W. Bicknell.

The next meeting of the section will be held in the Edison Auditorium, 39 Boylston Street, at 7:30 p. m., April 20.

Demonstration of Lightning Phenomena

At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and of the Electrical Section of the Western Society of Engineers held on March 19, Prof. E. E. F. Creighton delivered a very interesting lecture on and gave a demonstration of many lightning phenomena. He distinguished six different methods of conducting electric current: First, an ionization discharge by air or gases. It was formerly believed that air was a perfect non-conductor, but it can be shown to be very slighting conducting at all times. The second is the brush discharge formed in high-tension work. Third, is the spark discharge; when the current density in the brush discharge becomes great enough, the characteristic blue brush effect condenses into a thin streak or spark. Fourth, arc discharge; when the spark from the electrodes is heavy enough to vaporize them, the discharge is carried by this vapor; this travels at about 2,000 feet per second; a counter draft equal to it can be used to stop the arc. Fifth, is the most common conduction, viz., by metals. Sixth, a class of conglomerate conductors has been discovered which do not obey the ordinary laws of conductivity; in this type of conductor the current increases very much more rapidly than the pressure applied. Seventh, is the well-known phenomena of electrolytic conduction by ionization.

The lecturer showed along two parallel copper wires that were separated about the room, the phenomena of standing waves by producing a spark between the middle points of the wires. By changing the frequency the spark was produced between the ends of the wires. Four different lighting or analogous effects can be distinguished from which transmission lines must be protected. First, the direct stroke of lightning, which cannot be commercially taken care of on account of the expense that would be required to guard against it; this phenomenon is very rare, and about the only thing to do about it is to trust to Providence. A very common lightning effect is that caused by induced charges along the line. These are of very high frequency and can be very well taken care of by good lightning arresters. The quite frequent trouble is due to low-potential discharges caused by switching. These also can be well taken care of by efficient arresters. A fourth phenomenon to guard against is a long-duration discharge, due to continuous arcing or surges. For this the aluminum-cell lightning arrester is the only protection that has as yet been developed. The development of the various types of lightning arresters was then traced, and their particular suitability for various conditions explained.

Professor Creighton showed experimentally that the end turns of transformers and other inductive apparatus receive the highest potential of the surges, and therefore require an extra amount of insulation. Before the conclusion of the lecture, a number of tests were made to determine the equivalent needle gap of a multi-gap arrester and of an aluminum-cell arrester. With the former, twenty-three gaps of one-thirty-second inch each had an equivalent needle gap of about two inches. For higher frequency the equivalent gap was only one-third inch. The lecturer also showed the deficiency of this type of arrester when provided with resistance paths and of the bad effects of resistance and of inductance in a lightning arrester in general. The aluminum-cell lightning arrester gave an equivalent needle gap of almost nothing.

In reply to several questions about the horn-type arrester, the lecturer stated that the original form of this type has entirely disappeared, and that with an aluminum arrester the horn gap is very good; otherwise, it is not so reliable. He described the phenomenon of the film in the aluminum arrester and how its maximum critical voltage may be changed by changing its electrolyte. The aluminum-cell rectifier and condenser are not efficient, because there is such a large energy lost in re-establishing the film. The sparking of one cell of two placed in series on 600-volt trolley system is due to uneven balance between the two cells. A remedy is to put in parallel with each of the cells a group of five incandescent lamps in series.

Hydroelectric Power for Cotton Mills in India and Japan.

While the Bombay mill owners are discussing the probable advantages of electric power supply, their Japanese rivals seem to be going ahead with similar undertakings. By a strange coincidence, the project that is to be worked under the Bombay Hydroelectric License, resembles the Japanese enterprise in many ways, says the *Indian Textile Journal*. Both the schemes are laid out for a supply of 50,000 to 60,000 horsepower, and the estimated costs will be about the same.

The Japanese project will comprise the largest waterpower plant so far undertaken in that country. There will be three generating stations in the province of Shiznoka, the city of Tokyo, which is about a hundred miles to the west, taking up the bulk of the power. Six three-phase, twenty-five-cycle generators of 5,600 volts will be coupled direct to waterwheels of 13,500 horsepower capacity. The length of the transmission line will be about 105 miles.

In the case of the Bombay hydroelectric supply, the generating station will be situated near Khapoli, below Lonavla, about forty miles from Bombay. The water will be impounded and stored in large reservoirs, which will be formed by constructing masonry dams across three valleys. From these, water will flow through pipes at a head of nearly 1,500 feet into the turbines. The electrical energy generated will be raised to 45,000 volts, and conducted to Bombay by overhead transmission wires. According to the present arrangement, the current will only be available in Bombay for distribution among mill owners and other users of power. The Japanese undertaking, however, will allow of the distribution of the current in Tokyo, Yokohama and adjacent cities and towns. There is another remarkable similarity in the two undertakings—namely, that contracts have already been made for the supply of 20,000 kilowatts from the Japanese generating plant, while it is now a matter of common knowledge that nearly 20,000 horsepower has been guaranteed to the promotors of the Tata hydroelectric scheme in Bombay.

$23,240,200 Corporation Incorporated to Take Over Vanderbilt Trolleys.

The New York State Railways, with principal offices in Rochester, N. Y., organized to take over the properties of the so-called Vanderbilt system of up-state electric railways, capital $23,240,200, filed a certificate with the secretary of state on March 23, showing it had consolidated the Rochester Railway, the Rochester & Sodus Bay, and the Rochester & Eastern Rapid Railway companies.

The officers of the new company are: President, Horace E. Andrews, Mentor, Ohio; vice-presidents, William K. Vanderbilt, Jr., Great Neck, L. I., and John J. Stanley, Cleveland, Ohio; treasurer, Edward L. Rossiter, Greenwich, Conn.; secretary, Joseph C. Collins, Rochester.

The directors not included among the officers are William C. Brown, Albert H. Harris, Edward V. W. Rossiter, New York, and John Carstense.

Annual Report of the Directors of American Telephone and Telegraph Company to the Stockholders for the Year Ended December 31, 1908.

President Theodore N. Vail's report of the directors of the American Telephone and Telegraph Company to the stockholders for the year ended December 31, 1908, shows the company in fine condition. Abstracts of this report follow:

The number of stations at the end of the year operated directly by the associated companies which constitute the Bell system in the United States was 3,215,245, an increase of 179,712. In addition to this number, there were 1,103,144 exchange and toll stations connected to the system by toll and long-distance lines, but operated by local, co-operative and rural independent companies or associations having sub-license or connection contracts. Adding, also, telephones employed for private-line purposes, there was a total of 4,364,629 stations connected to the Bell system as against 3,839,000 stations at the close of the previous year, an increase of 525,629 stations.

The total mileage of wire in use for exchange and toll service was 9,830,718 miles, of which 1,220,126 were added during the year. These figures do not include the mileage of wire operated by sub-licensees.

Including the traffic over the long-distance lines, but not including sub-licensees, the daily average of toll connections was about 463,000, and of exchange connections about 18,500,000, as against corresponding figures in 1907 of 494,000 and 18,130,000; the total daily average for 1908 reaching 18,963,000, or at the rate of about 6,106,000,000 per year.

During the year $39,736,700 were applied out of revenue to maintenance and reconstruction purposes. The total amount of maintenance and reconstruction charged against revenue for the last six years was over $186,700,000.

As fast as improvements in transmission methods make it possible, underground construction for long-distance trunk lines is being done. There are now underground conduits and cables between New York and Philadelphia, Chicago and Milwaukee, and a substantial part of the way between New York and Boston.

Of the total mileage of exchange wires, over fifty-seven per cent is underground. Of the total value, eighty-four per cent is copper and sixteen per cent iron. Of toll wires, ninety-one per cent is copper and only nine per cent iron.

Of the total value of the telephone plants owned by the American Telephone and Telegraph Company and associated companies: Real estate constitutes nine per cent; underground conduits and cables, twenty per cent; copper wires and aerial cables on poles, eighteen per cent; pole lines not including wires, twenty-six per cent ($8,000,000 of this represents ownership of rights-of-way over private property); iron wires, four per cent; central-office and substation equipment, twenty-three per cent.

As to the depreciation of property, real estate is standard and established. Underground conduits can be classed with real estate, or, rather, with permanent construction, on long-term ground rents. Cables and copper wires have shown very small depreciation, and experience has not yet established a definite rate; there is, however, a net scrap value of forty per cent. Iron wires have a life of from eight to fifteen years. Pole lines have a life of from ten to sixteen years. Central-office and substation equipment have a depreciation dependent on their character, the condition in which they are maintained, and on the policy of renewal or replacement by new or improved apparatus.

The associated operating companies of the United States (not including the American Telephone and Telegraph Company) commenced the year with a reasonable indebtedness, which has, however, been substantially reduced. The obligations of those companies to other than the American Telephone and Telegraph Company, decreased for the year $2,709,000, while the cash on hand increased at the same time $2,295,000—a net improvement in condition of $5,004,000.

During the year the Western Electric Company decreased its indebtedness $6,225,000 and decreased its cash $1,194,000, making a net improvement of $5,031,000 for that company.

The total improvement of our associate operating and manufacturing companies in the United States was thus over $10,000,000, bringing the current and floating indebtedness of all the associated companies well within the limits of current operations.

PHYSICAL VALUATION OF TELEPHONE PLANTS.

For the purpose of determining the relation between the physical plant and the capitalization, a valuation of the exchange, toll and long-distance-line plant included in the Bell system in the United States was made in 1907. The valuation was based on the replacement cost of the existing plant. This appraisement gave our plants a value of $35,000,000 in excess of the obligations outstanding against them.

BELL TELEPHONE COMPANIES IN UNITED STATES (AMERICAN TELEPHONE AND TELEGRAPH COMPANY NOT INCLUDED). COMPARISON OF EARNINGS AND EXPENSES, 1907 AND 1908. (DUPLICATIONS EXCLUDED).

	1907.	1908.
Gross earnings	$120,753,200	$127,117,200
Expenses:		
Operation	$ 48,731,600	$ 49,083,800
Maintenance	34,665,700	37,204,200
Taxes	4,510,700	5,173,600
Total expenses	$ 87,908,000	$ 91,461,600
Balance net earnings	$ 32,845,200	$ 35,655,600
Deduct interest	7,025,500	6,973,700
Balance	$ 25,819,700	$ 28,681,900
Deduct dividends	19,206,100	21,605,300
Undivided profits	$ 6,613,600	$ 7,076,600

COMBINED BALANCE SHEET, 1907 AND 1908 (DUPLICATIONS EXCLUDED).

Assets.	Dec. 31, 1907.	Dec. 31, 1908.
Contracts and licenses	$ 8,800,200	$ 8,107,600
Telephone plant	447,284,600	475,034,600
Supplies, tools, etc	16,238,700	14,358,500
Receivables	39,961,200	36,359,400
Cash	6,435,300	8,730,400
Stocks and bonds	22,642,300	23,450,400
Total	$541,362,300	$566,540,900
Liabilities.		
Capital stock	$348,129,400	$375,891,600
Funded debts	37,115,300	39,649,300
Bills payable	92,615,100	85,179,300
Accounts payable	19,415,500	17,205,500
Total outstanding obligations	$497,275,300	$517,926,200
Surplus	35,125,200	34,491,500
Depreciation reserves	8,961,800	14,123,200
Total	$541,362,300	$566,540,900

COMPARISON OF EARNINGS AND EXPENSES, 1907 AND 1908 (ALL DUPLICATIONS, INCLUDING INTEREST, DIVIDENDS AND OTHER PAYMENTS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY BY ASSOCIATED HOLDING AND OPERATING COMPANIES, EXCLUDED).

Earnings:	1907.	1908.
From exchange service	$ 90,782,300	$ 95,847,700
From toll service	36,291,600	37,600,100
From other sources	5,933,000	6,568,600
Total earnings	$133,006,900	$140,016,400
Expenses:		
Operation	$ 47,554,800	$ 47,329,300
Maintenance	38,372,800	41,027,200
Taxes	5,013,700	5,685,900
Total expenses	$ 90,941,300	$ 94,042,400
Balance net earnings	42,065,600	45,974,000
Deduct interest	10,654,100	11,034,500
Balance	$ 31,411,500	$ 34,939,500
Deduct dividends	18,714,100	21,338,100
Undivided profits	$ 12,697,400	$ 13,601,400

WESTERN ELECTRIC COMPANY.

The business of the Western Electric Company, like that of all other manufacturing companies, has shown a shrinkage for the year—not entirely, however, from the same causes.

The business of the Western Electric Company, outside of that with the American Telephone and Telegraph Company and associated companies, shows a slight

increase over 1906—the year of the largest aggregate business of the company.

The year's business would have shown a manufacturing profit sufficient to have provided for all charges if the company was expected to do only the amount of business equal to that done last year, but under an organization such as is necessary to care for the increasing business of the last five years and for the prospective business of the next five years, and after charging off even more than the usual depreciation, showed a loss.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY—BALANCE SHEET, DECEMBER 31, 1908.

Assets.		
Stocks of associated companies.	$235,729,305.60	
Bonds and other obligations of associated companies.	73,289,388.92	$309,018,694.52
Telephones	$ 9,599,137.26	
Real estate	2,181,728.67	
Long-distance telephone plant	42,650,989.97	54,431,855.90
Cash and deposits	$ 41,137,264.33	
Temporary cash loans	7,988,000.00	
Short-term notes	3,277,466.52	52,402,730.85
Accounts receivable.		2,969,140.64
Treasury stock		22,110,400.00
		$440,932,821.91
Liabilities.		
Capital stock	$180,587,000.00	
Surplus	16,225,917.64	$196,812,917.64
Four per cent collateral trust bonds, 1929	$ 53,000,000.00	
Four per cent convertible bonds, 1936	136,000,000.00	
Four per cent American Bell bonds, 1908	48,000.00	
Five per cent coupon notes, 1907	6,000.00	
Five per cent coupon notes, 1910	25,000,000.00	
Dividend payable January 15	3,169,532.00	
Interest and taxes accrued, but not due	3,709,232.91	
Accounts payable	1,302,979.83	222,235,744.74
Depreciation reserve.		21,884,159.53
		$440,932,821.91

AMERICAN TELEPHONE AND TELEGRAPH COMPANY—COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES.

Earnings:	1907.	1908.
Dividends	$11,805,166.81	$13,280,127.54
Interest and other revenue from associated and licensed companies	9,307,023.72	9,720,466.04
Telephone traffic (net)	3,901,653.93	3,976,512.07
Real estate	162,228.49	160,007.95
Other sources	433,598.31	761,856.45
	$25,609,671.26	$27,898,970.05
Expenses	2,130,381.16	2,003,956.06
Net earnings	$23,479,290.10	$25,895,013.99
Deduct interest	7,209,902.16	7,773,306.73
	$16,269,387.94	$18,121,707.26
Dividends paid	10,943,644.00	12,459,156.00
Balance	$ 5,325,743.94	$ 5,662,551.26
Carried to reserves	3,500,000.00	3,000,000.00
Carried to surplus	1,825,743.94	2,662,551.26
	$ 5,325,743.94	$ 5,662,551.26

The work of moving the manufacturing department from Chicago to Hawthorne, Ill., is proceeding as rapidly as possible, and the real estate in Chicago is on the market for sale. This property, which showed on the books of the company at $2,700,000, has been appraised by the Chicago Real Estate Board at $3,755,000, and offers have been made for part at more than the appraisement.

There were outstanding in the hands of the public at the close of the year 1,584,766 shares of capital stock of the American Telephone and Telegraph Company. There were 26,370 shareholders with an average holding of sixty each; 26,213 shareholders held less than 1,000 shares each—an average of forty-three each; 153 shareholders from 1,000 to 10,000 each, with an average holding of 2,140 each; and four 10,000 or over each, holding a total of 121,516 shares.

The balance of the $150,000,000 convertible bonds were taken by the bankers who bought the first $100,000,000. These became convertible beginning March 2, 1909.

With the proceeds, the financing of the company for all current operations, including financing of the associated companies, is completed for 1909 and 1910. This, of course, includes the payment of the $25,000,000 five per cent notes due in 1910, and also provision for the $6,000,000 five per cent Western Telephone and Telegraph Company's notes due in 1909.

As to future financing, it is believed that it will be possible to so organize that a great part, if not all, of semi-urban and rural expenditures can be financed locally and a considerable part of all other financing. This will reduce the necessary demands on the American Telephone and Telegraph Company for current operations to an amount which can be very easily taken care of.

A New Idea in Generators.

A local Illinois paper in describing the starting up of a new electrical equipment gives the following information:

"The generators on this machinery are the latest pattern manufactured, and are altogether the reverse from the original idea of generating electric current. Instead of generating the electric current by friction on copper commutators and carbon brushes, the electric current is generated through wave current, and there is no friction of any kind whatever. The main generator is composed of a field of wires on a wheel sixteen feet in diameter. On the outside of this there is a stationary armature composed of copper wire, with an air space between the two. The field is magnetized with the direct-current generator and passes from the field in wave currents into the generator, thence through the main wires to the switchboard. It is simply on the same plan as picking up a small piece of steel with a common magnet, such as boys play with. Everything ran along smoothly until quitting time at 5:30. The machinery was started up again on Monday morning and ran all day with excellent results."

Timber Seasoning and Wood Preservation.

In recent years the importance of preserving timber from decay by the use of various antiseptics has been generally recognized in the United States. The value of properly seasoning timber before such treatment is not so generally known, though it is one of the most important features of the treatment.

There are three main advantages to be derived from the proper seasoning of timber, namely: The increase in strength of the timber, the greater ease of injection of antiseptics for preserving the timber, and the saving in freight charges due to the decreased weight.

From thorough tests made by the United States Forest Service on various pieces of timber, it appears that thoroughly air-dried or seasoned timber has about double the strength of the green material. It is well known to all operators of wood-preserving plants that antiseptics are not only difficult to inject into green wood, but that it is practically impossible to obtain a uniformly satisfactory treatment of such material at an economic cost, for the purpose of insuring a prolonged life.

The last item would at first seem too trifling to be worthy of discussion, but from data obtained only recently it appears that western yellow pine lost fifty per cent of its green weight after three to five months' seasoning. This means a saving of fifty per cent of the freight charges and a corresponding saving in the handling of the timber, and is therefore too important a point to overlook.

Considering these three points, it will be seen that there is not only a material saving in the seasoning of timber, but also a proportionate increase in the value of timber as a structural material. The seasoning of timber is never an expensive operation, even when done artificially. In the southern parts of the United States a satisfactory degree of seasoning could be obtained by exposure of the timber to the air for a period of three to six months. In some of the northern states, however, a somewhat longer period is necessary to secure satisfactory results.

THE ECONOMY OF THE ELECTRIC DRIVE AS APPLIED TO BRICK AND TILE PRODUCTION.[1]

BY E. A. LOF.

The question of the advisability of electric drive in brick and tile factories may at the present be regarded as decided in the affirmative. There are a great many points that affect the character of power distribution, and in addition to the saving in cost of supplying power to the productive machinery, all these other factors should be given due consideration. The satisfactory and economical handling

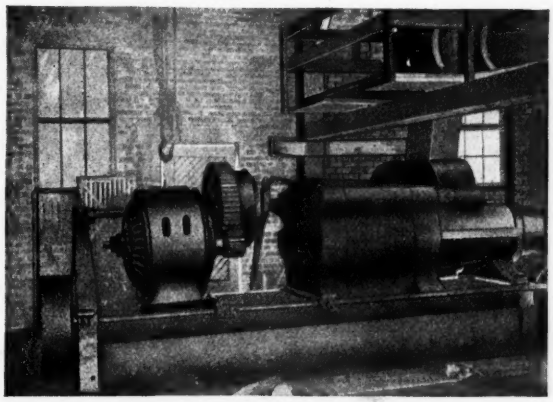


FIG. 1.—INDUCTION MOTOR DRIVING A BRICK MACHINE.

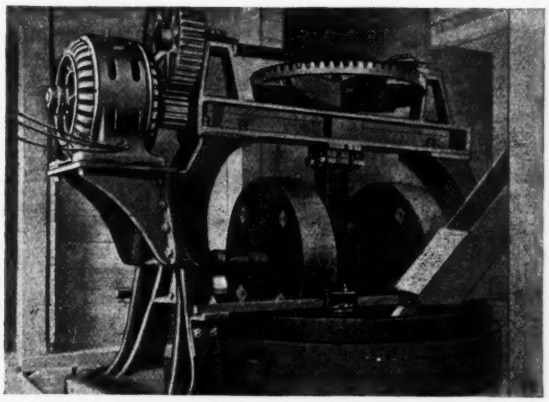


FIG. 2.—INDUCTION MOTOR DRIVING A DRYING PAN.

The satisfactory and economical handling of raw and finished material, reliability of service and the preventing of injury to individuals must also be looked out for. Future extensions of the plant should be made possible without unduly rearranging the original equipment.

The electrical distribution of power so fully meets the requirements of brick factories that it has become recognized as pre-eminently the proper method for use in large as well as in smaller plants.

In making a choice between the various means for power distribution, a manufacturer should naturally bear in mind the effect that the various arrangements may have on the several elements that enter into the manufacturing cost. Manufacturing requirements demand the earning of dividends, and this in turn necessitates that the product shall be turned out at the least total cost.

A mechanical system of driving is, besides inefficient, also inelastic. As machines are added time and again, the shafting, bearings and hangers become so strained and twisted that it is a wonder that they do not break down altogether. The electric system, on the other hand, is perfectly elastic. Motors can be added from time to time without in any way affecting the efficiency of the system. Machines can be put in positions which would be impossible if they were driven by means of belting, and, besides this, a perfect control of the individual machines is made possible with the electric system.

The fact, however, must never be overlooked that the generation of electricity by steam power must necessarily be dearer at the generator than the steam power itself. It is in the method of transmission and application that electricity scores, and by installing the motors right near the productive machines, avoiding all unnecessary losses we can secure the highest economy and beat commercially every other method of driving.

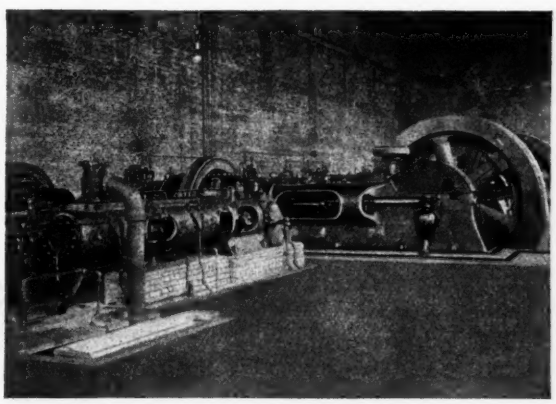


FIG. 3.—POWER PLANT OF COLUMBUS AND HOCKING CLAY CONSTRUCTION COMPANY, KACHELMACKER, O.

The first cost of the power generating and distributing system is often of less importance as compared with other factors, which is, however, not the case in regard to the efficiency of the system. The losses in the distributing system naturally affect the size of the generating plant, and the value of this lost power is an item of great importance. With mechanical drive, these losses are constant as long as the shafting is running, whether the productive machinery is running or not. This is not the case with electric drive, as at no load, when the motors are not running, there is no loss taking place in the system.

An accurate knowledge of the absolute loss of power in driving shafts and belts would be of great value in determining the exact gain that would be affected if electric drive was substituted for mechanical drive. There have been made many tests to determine these losses, and it has been shown with the plant running at full load they will range from thirty to fifty per cent; an average for clay-working plants being forty per cent. Should only a few machines be running, the losses may, of course, come up to seventy-five or eighty per cent of the generated power, or, in other words, four-fifths of the coal consumption is wasted in friction losses. With the electric drive the losses are easily determined and will not exceed twenty-five per cent, of which twelve per cent is consumed in the motors, five per cent in the wiring and eight per cent in the generators. With the electric system it is possible to insert indicating instruments in the various circuits, and a complete check can at all times be had on the power consumed by the various machines. This is particularly valuable in testing departments, in order to determine the power required for driving brick

1. Abstract of a paper read before the Iowa Brick and Tile Association, Mason City, Ia., January 14, 1909.

machinery for different sorts of clay and in establishing accurate data of this nature.

The advantage of electric drive is especially apparent where the conditions demand the location of the power house at a distance from the manufacturing buildings. Also, when cheap electric power can be purchased from an electric power company, the value of electric drive is still further accentuated.

The alternating-current three-phase system is probably the best adapted for brick factories. This system is simpler than the direct-current system, in that no current has to be delivered to the rotating element of the motor through brushes and a commutator. The brushes and the commutators are the only parts of the direct-current motors in which trouble is liable to arise, due to accumulation of dust and dirt. Simplicity, durability and freedom from breakdown are, therefore, the main advantages of the alternating-current motor.

The pressure best suitable is 220 volts, as the danger by coming in contact with the wires is not very great, and as this pressure can directly be used for the lighting system, which in all cases naturally is provided. Where very large motors are used, it may be advisable to use a pressure of 440 or 550 volts, as with this voltage the size of the wiring can be considerably reduced. Step-down transformers for the lighting system will, of course, have to be provided in such a case. The frequency of the system is usually sixty cycles, as the same gives good lighting results, at the same time not causing any excessive inductive effects.

For driving brick machinery, where a high starting torque is required, the induction motors with phase-wound secondaries will exactly meet the conditions. The secondary winding itself has a very low resistance, which means high efficiency and good regulation. By the insertion of external resistance in the secondary winding the motor will be able to develop a maximum torque of at least two times the normal running torque. Each motor should be provided with its own starter complete with overload and no-voltage features.

The operation of every machine and conveyor by its own motor produces a very satisfactory appearance, but it may not return the most economical result. Very small motors are not so efficient as larger ones, and besides they are more expensive per unit of power. For this reason it will frequently be found advisable to drive a group of smaller machines with one motor of a larger capacity, providing that the shafting for these machines does not become too extensive.

An example showing the actual saving of an electrically driven plant as compared to a mechanically driven one may prove of interest. Through the courtesy of the American Clay Machinery Company, of Bucyrus, which company has installed several very successful electric-driven plants, I have been fortunate in obtaining data that will give a very accurate idea of the saving that can be accomplished.

Assume a brick plant with a yearly production of 25,000,000 bricks, which has to be equipped with the following productive machines:

	H. P.
One brick machine, consuming	75
One pug mill	50
Three dry pans, each	35
Repressers and cutter	35
Elevators	20
Conveyors	8
One exhaust fan	50
One disc fan	10

This will total approximately 350 horsepower, the fans running twenty-four hours, but all of the other machinery only ten hours per day.

STEAM-DRIVEN PLANT WITH SHAFTING.

The average load during the period when the plant is running will be approximately eighty-five per cent.

COST OF INSTALLATION.

One 600-horsepower boiler equipment, complete with stacks, pumps, piping, etc.	$ 9,000
One 400-horsepower engine	4,500
One 60-horsepower engine	2,200
One 15-horsepower engine	600
Belting, shafting, complete	2,500
Total cost of installation	$18,800

HORSEPOWER-HOURS PRODUCED PER YEAR.

400 H. P., 85%, 10 hours, 300 days	=1,020,000
75 H. P., 85%, 24 hours, 300 days	= 460,800
Total	1,480,800

COST OF PRODUCTION.

Fuel, eight pounds per horsepower-hour=5,900 tons at $2	$11,800
Interest, depreciation, taxes, insurance, etc., on boilers and engines, 15% on $16,300	2,445
Interest, depreciation, taxes, insurance, etc., on shafting and belting, 30% on $2,500	750
Oil, waste, etc.	750
One day engineer at $75	900
One day fireman at $60	720
One night engineer at $60	720
Total cost of operation	$18,085

STEAM-DRIVEN PLANT WITH ELECTRIC MOTORS.

The average load in this case is only eighty per cent.

COST OF INSTALLATION.

One 500-horsepower boiler equipment, complete with stack, pumps, etc.	$ 7,000
One 350-horsepower engine	4,000
One 75-horsepower engine	2,200
One 250-kilowatt, 3-phase generator	2,800
One 50-kilowatt, 3-phase generator	1,050
Cabling	750
One 50-horsepower motor for pug mill	475
One 75-horsepower motor for brick machine	675
Three 35-horsepower motors for dry pans	1,050
One 35-horsepower motor for cutters and repressers	350
One 20-horsepower motor for elevators	300
One 8-horsepower motor for conveyors	115
One 10-horsepower motor for disc fan	145
One 50-horsepower motor for exhaust fan with variable-speed regulator	550
	$21,460
Less extra cost for buildings	2,500
Total cost of installation	$18,960

HORSEPOWER-HOURS PRODUCED.

350 horsepower, 80%, 10 hours, 300 days	=840,000
75 horsepower, 80%, 24 hours, 300 days	=432,000
Total	1,272,000

COST OF PRODUCTION.

Fuel, seven pounds coal per horsepower-hour=4,450 tons at $2	$ 8,900
Interest, depreciation, taxes, insurance, etc., 15% on $18,960	2,845
Oil, waste, etc.	500
One day engineer at $75	900
One day fireman at $60	720
One night engineer at $60	720
Total cost of operation	$14,585

Cost with mechanical drive.....$18,085
Cost with electric drive..... 14,585

Saving by electricity.....$3,500
= 19½ per cent.

For gas-driven plants, the respective costs will be somewhat less than with steam-driven.

Assume the same plant as before, but with gas engine, we get:

GAS-DRIVEN PLANT WITH SHAFTING.

COST OF INSTALLATION.

Producer equipment	$11,000
Gas engines	22,000
Belting and shafting	2,500
Total	$35,500

COST OF PRODUCTION.

Fuel, 1½ pounds of coal per horsepower-hour=1,010 tons at $2.50	$ 2,525
Interest, depreciation, taxes, etc.	5,700
Oil, waste, etc.	500
One day engineer at $75	900
One helper at $40	480
One night engineer at $75	900
Total	$11,005

GAS-DRIVEN PLANT WITH ELECTRIC MOTORS.

COST OF INSTALLATION.

Producer equipment	$ 9,000
Gas engines	18,000
Generators	3,850
Cabling	750
Motors	3,660
	$35,260
Less extra cost for building	2,500
Total	$32,760

COST OF PRODUCTION.

Fuel, 1½ pounds per horsepower-hour=950 tons at $2.50	$ 2,275
Interest, depreciation, taxes, etc.	4,920
Oil, waste, etc.	300
One day engineer at $75	900
One helper at $40	480
One night engineer at $75	900
Total	$ 9,775

Cost with mechanical drive.....$11,005
Cost with electric drive..... 9,775

Saving by electricity.....$1,230
= 11 per cent.

Another place where a considerable saving can be made is by adopting electricity for the hauling of the clay from the clay banks to the factory. In one case in a brick plant outside of Chicago where this system has been installed, the operating force alone for this part of the plant was reduced by about ten men.

That there is a very large field open for the introduction of electric drive in existing brick plants and the tremendous

saving that thus could be accomplished is shown by the government's statistics.

Number of plants	4,643
Number of plants reporting	3,476
Number of steam engines	4,113
Total horsepower	246,200
Number of gas engines	220
Total horsepower	6,245
Number of electric motors	128
Total horsepower	3,036

Before concluding this paper it would be well to consider what one of our prominent brick-machine manufacturers has to say in regard to the electric drive:

"Try to picture in your mind a brick plant free from line shafting and the necessary millwright work to support it, or the necessary brick or concrete piers. No line-shaft bearings to require proper oiling. No pulleys. No couplings to work loose. No belting to fan the air, break or get loose and slip. No constant renewals and sewing of same. No danger of employes being maimed by being caught in belts, and such accidents to be followed up by annoying and expensive lawsuits. And when the 'electric juice' is taken from a centralized plant or trolley line there will be no boilers, no engines, no engineer, no fireman, no water, no coal, no smoke, soot, ashes, or dust. With the machinery properly built, setting on good foundations, driven by direct-connected motors, a greater portion of the noise is removed. Then imagine a drier drying your brick with waste heat drawn from kilns being burned with producer or natural gas, thus eliminating smoked-up brick in the drier, no coal lying around the kilns, no men to handle the coal and ashes from the kiln, no smoke rolling from the kilns. This is not a dream, but the future brickmaker's millennium, which a great many are enjoying today."

To Regulate Telephones in New York.

Assemblyman Cuvillier, of New York, has introduced a bill prohibiting telephone pools, trust agreements and combinations. It also requires all long-distance telephone companies and all local exchanges to admit telephone connections at all exchanges with all rural lines applying therefor at the maximum rate of twenty-five cents per month for switch charges for each telephone on any rural line admitted and fixes minimum rates to be charged for messages according to the distance. The violation of any of the provisions of the act is made a misdemeanor punishable by a fine of not less than $1,000 or more than $5,000, or imprisonment. The company violating the pool and trust provisions also forfeits franchises.

Iowa Electrical Association.

The annual convention of the Iowa Electrical Association will be held at Cedar Rapids, Iowa, on Wednesday and Thursday, April 21 and 22. The association has had a very useful career and is steadily growing in numbers and in its importance to the central stations in the state of Iowa. The programme for the coming meeting has been arranged so as to reflect the greatest practical benefit to the delegates attending the convention, and there will be a discussion of operating experiences from every angle and viewpoint. The following programme has been announced:

WEDNESDAY, APRIL 21, 10 A. M.

Address of welcome, Honorable J. T. Carmody, mayor of Cedar Rapids.

Response, P. B. Sawyer, Des Moines.

Address of President, L. D. Mathes, Dubuque.

Reading of minutes.

Committee reports.

Paper, "Portable Vacuum Cleaners," O. A. Brownell, Lake City.

AFTERNOON SESSION, 2 P. M.

Paper, "Application of Electricity in the Conduct of the Modern Home," Mrs. L. D. Mathes, Dubuque.

Paper, "The Effect on Central-Station Revenues of the Introduction of the Tungsten Lamp," Thomas Ferris, Osage.

Twenty-minute talk, "On Ornamental Curb-Line Illumination," D. F. Fradette, Des Moines.

General discussion.

THURSDAY, APRIL 22, 10 A. M.

Paper, "The Amount of Daylight Business Sufficient to Justify Twenty-four-hour Service, and Methods Adopted to Increase the Daylight Load," M. A. Harrison, Nevada.

Paper, "Aid of Prismatic Reflector to the High-Efficiency Unit," Morgan P. Ellis, New York.

General discussion, "On the Progress of the Introduction of Heating Units by Central-Station Companies." Discussion lead by representatives of the trade.

AFTERNOON SESSION, 2 P. M.

Paper, "The Story of a Successful Sign Campaign, with Facts and Figures," J. B. Lindl, Dubuque.

Twenty-minute talk, "Selling Electrical Domestic Appliances in a Small Town," W. W. Sterns, Humboldt.

Discussion, "Of the Importance of Close Inspection of Customer's Installations," W. J. Greene, Cedar Rapids.

Twenty-minute talk, "Does It Pay the Central Station to Be Broad-Gauged in Dealing with Its Customers?" by the president.

Executive session.

The association will provide, free of any expense, a large exhibition hall and will also supply all of the electrical energy required by exhibitors. This practice was introduced last year and met with such hearty appreciation by the manufacturers, that it has been made a permanent institution. Reservation for space can be made through W. N. Kieser, secretary, Des Moines, Iowa.

Louisville Electrical Show.

The Southern Electrical and Industrial Exposition, which will be held at the First Regiment Armory in Louisville, Ky., April 12 to 24, will be the most important electrical event ever held south of the Ohio River. Louisville and the South generally are notably deficient in point of electrical development, and the object of this exposition is to awaken greater interest in the use of electricity. The industrial end of the exposition, however, has not been neglected, and those who attend will be amply repaid in this connection also.

The exposition is being promoted by the Louisville Commercial Club, which has a known capacity for this sort of work. The exposition is expected to be productive of the best results, since there is now being waged in the South the greatest advertising campaign ever attempted on an occasion of this kind. The entire South has been flooded with literature and souvenirs. The railroads of the South have also come nobly to the front, having fixed the exceptionally low rate of one fare plus twenty-five cents for the round trip from any point south of the Ohio River and east of the Mississippi River.

Sufficient space has been sold to date to guarantee the success of the project and among the exhibitors will be found some of the most prominent manufacturers of electrical apparatus in the North and East.

Work Begun on Dirigible Wireless Airship.

It is announced that drawings and plans have been completed and construction will begin at once at the balloon factory of Leo Stevens, in New York city, of a dirigible balloon, which will be controlled by means of wireless apparatus. The dirigible is the invention of M. O. Anthony, of New York.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER VII. (PART I.)—THERMAL APPLICATIONS.

ELECTRIC HEATING.

Electric heating as applied to cooking, the heating of rooms, cars and the like, is adapted equally well to alternating or direct currents, depending as it does on the heat generated by an electric current in overcoming the resistance of a conductor. There is nothing particularly new in the applications of electricity for such purposes as far as the principles that are involved are concerned. Many very ingenious devices for their utilization in sundry ways have been put upon the market. The great difficulty in the general usage of electric heating devices is that the cost is considerable as compared to ordinary fuels. In many cases, however,

FIG. 142.—COILED HEATING UNIT.

cost is sacrificed to convenience, and it is in such a field that these appliances find special favor.

There is no better method of obtaining a constant temperature than by means of electrically heated coils, and the temperature can easily be regulated by changing the value of the current.

Probably the most common method of electric heating is that in which the current flows through wires imbedded in an insulator. A heater of this type is illustrated in Fig. 142. A coil of resistance wire is wound in the form of a flat spiral with mica insulating strips between its convolutions and held against a layer of quartz grains imbedded in enamel.

Another form of heater is illustrated in Fig. 143 and is known as the cartridge type. It consists of a thin strip of resistance metal wound edgewise, insulated with fireproof cement and then inserted in a mica-lined brass tube, which is then filled with cement, leaving the terminals projecting, as shown in the figure. One or the other of these forms is ordinarily used for cooking utensils, as illustrated in Fig. 144, for soldering irons, shaving mugs, flatirons and cigar lighters. In the cigar lighter a thin piece of perforated mica is placed in a metal cap which fits a porcelain plug base and protects the heating coils. To light a cigar

FIG. 143.—CARTRIDGE-FORM HEATING UNIT.

it is only necessary to place the end against the perforated disc; the hot air drawn through the holes in the mica ignites the cigar even before the disc becomes red.

An application where steady, uniform heating is requisite is in laundry machines and electrically heated electrotypers' matrix dryers. Aside from these there are innumerable other applications, such as apparatus for distilling water, glue pots, tire vulcanizers and many others.

Fig. 145 shows an application based upon a somewhat different principle. Since in an incandescent lamp all the electrical energy not converted into light is turned into heat, it is possible to build an attractive air heater or radiator, using special incandescent lamps heated to a low brilliancy. The filaments are long and thick.

There is another system of electric heating based upon the heating of a high

FIG. 144.—ELECTRIC BROILER.

resistance which is obtained by painting a thin film of gold or platinum upon mica. These thin strips of mica, carrying a mere film of conducting powder which has been pasted on with a flux and then brought to a high temperature, are packed close together with strips of mica between the conducting surfaces.

Rods made of a fused mixture of metallic powder and quartz or kaolin which has been subjected to great pressure are sometimes used as the resisting medium for converting electrical energy into heat energy.

Still another mixture invented in Germany and known as kryptol is said to consist of a mixture of graphite, carborundum, silica and clay. The size of granules of kryptol varies with the voltage used; they are spread out in a nonconducting vessel which will stand high temperatures and the current is passed through by means of graphite electrodes. Temperatures up to 3,600 degrees F. can easily be obtained in this manner.

Plan for Lengthening Subway Platforms.

The New York Public Service Commission has received a plan from the Interborough Rapid Transit Company for the lengthening of the local and express

FIG. 145.—LUMINOUS ELECTRIC RADIATOR.

station platforms in the New York subway thus permitting the use of ten-car trains on the express tracks and six-car trains on the local tracks. This will cost approximately $1,000,000, and can be done as an extra under the contract covering changes in the subway. The lengthening of the platforms was suggested by President Shonts at the time the Interborough Rapid Transit Company made its proposition to spend approximately $50,000,000 on increasing subways in New York city. He then stated that the work would take about ten months and would increase the facilities of the subway twenty-five per cent.

Great Eastern Telephone Company.

A special meeting of the Great Eastern Telephone Company will be held at the company's office, 32 Broadway, New York city, on April 5, to vote on increasing the capital from $1,000,000 to $50,000,000, and also to elect a board of directors.

Boston Edison Employes' Club.

Several years ago the management of the Boston Edison Illuminating Company sought, in common with other large corporations, to encourage a community of interest among its employes that would lead to closer harmony of social interests throughout the organization. In the early days, when the number of employes was small, the company was one big family. As the company grew, however, this intimate relation necessarily suffered to some extent. The employes were scattered over a larger territory and the general meetings were less frequent. A club was then started among the employes, and the results were satisfactory for a time, but the scope of the organization was not as complete as general experience in corporation development has proved possible in later years. It was found that a wider range of interests must be included. The list of employes was constantly increasing and it was useless to keep up a club organization unless the plans included "what everybody liked."

As a result the present Edison Employes' Club was organized in October, 1907. From the first the new club has proved remarkably successful. Of the 850 employes of the company over 600 are now members. There is a small initiation fee, together with the annual dues, which afford a fund, from which the expenses of the numerous entertainments can be defrayed. The membership includes the employes in every department, messenger boys, clerks, stenographers, linemen, electricians, firemen, engineers, oilers, bookkeepers and all of the officers of the company. Everyone takes an active interest and gives his ideas as to what should be done for entertainment and for improving the time through cooperative study or in clases that attend lecture courses.

The club holds its regular meeting on the first Friday evening of each month in the auditorium of the Edison Building. The management of the company has set aside the entire third floor of this building for the convenience of the employes, especially club members. The room is fitted with a stage, upon which plays and vaudeville entertainments are given. The conveniences are all that can be found in the modern club room. There is a complete library of books on electrical subjects, together with some fiction; and files of the daily papers, as well as of technical magazines, are maintained. Broad tables and comfortable chairs make the library room an attractive place for reading and study, and it is open generally throughout the day.

The club meetings are devoted chiefly to forms of entertainment, it being regarded as specially important to provide for suitable recreation. After the meetings the chairs are cleared away and dancing is enjoyed, and frequently light refreshments are served.

An especially important feature of the club work this winter is a course of lectures on "Electrical Engineering," by Prof. Sydney W. Ashe of New York. These lectures started with the elementary principles of electrical work, profusely illustrated by the use of a stereopticon and with experiments which Professor Ashe makes before his audience. He will take the class through almost the entire field of practical work in electricity. There will be twenty of these lectures, coming on every Thursday, until next June. To accommodate those who must work through the night the lecture is given at one o'clock in the afternoon, and repeated at seven o'clock in the evening for those who are at work during the day.

The young women employes of the company are as interested in the success of its work as are the men. They attend in large numbers every monthly meeting, and took upon themselves the programme for the March meeting. The entertainment included a short play, "The Bachelor's Dream," tableaux, vocal and instrumental solos. The men will give a similar entertainment in June. The annual dancing party of the club was held in Paul Revere Hall, Mechanics Building, February 12. This is always a great social function in the company and is attended by nearly all the employes.

Bowling contests have been especially keen among the club members this winter. Each department of the company selected a team, after competitive contest among the applicants, and the bowling series have been carried on with enthusiasm. The same plan of selection is adopted in the summer for the organization of baseball teams, so that each department gets out its best ball players.

The management of the club is under the direction of an executive committee, composed of one member from each department of the company, who is elected by the club members in his department. The present officers include: H. W. Moses, president; L. L. Elden, first vice-president; John J. Buckley, secretary; and John H. Guy, treasurer.

The Faraday Society.

The forty-second ordinary meeting of the Faraday Society was held on Tuesday, March 2, 1909, at the Institution of Electrical Engineers, 92 Victoria Street, London, S. W. Dr. N. T. M. Wilsmore occupied the chair. A paper was read by Dr. V. H. Veley on the rate of evolution of gases from homogeneous liquids. Dr. J. C. Cain and F. E. E. Lamplough discussed experiments by the latter gentleman on the same subject, and some criticisms were made by the former and answered by the latter. F. E. Weston described some experiments, with apparently anamalous results, on the rate of decomposition of a solution of $NaNO_2$ and NH_4Cl. Drs. Senter and Feilmann also contributed to the discussion. The next ordinary meeting of the society was announced to take place on Tuesday, March 30, when the following papers were to be read: "The Electro-Analysis of Mercury Compounds, with a Gold Cathode," by F. M. Perkin; "The Relation Between Composition and Conductivity in Solutions of Meta and Ortho-Phosphoric Acids," by E. B. R. Prideaux; "A New Electrical Hardening Furnace," by E. Sabersky; "Experiments on the Current and Energy Efficiencies of the Finlay Alkali Chlorine Cell," by F. G. Donnan.

Electrical Cooking and Heating Devices for a Modern Hotel.

The Stanley Hotel at Estes Park, Colo., one of the magnificent new hostelries in that part of the country, is to be operated entirely by electricity. F. O. Stanley, the proprietor, is sparing no expense in the equipment of the house, and has acquired his own waterpower, which, at a distance of four miles, will provide enough electric power to supply not only all of the electricity for use in the hotel, but for his own private residence and other cottages in Estes Park. Street lighting will also be supplied from the same source.

The owner is determined to make his hotel representative of the latest ideas in applications of electricity, and has ordered from the General Electric Company a complete electric-cooking equipment for his kitchen; electric water heaters for supplying hot water, for the baths, kitchen and laundry; electrically heated mangle for the laundry; flatirons, etc. When open for regular service this summer the hotel will be up to the minute in all of its electrical appointments.

NATIONAL ELECTRICAL CODE RULES.

ANNUAL MEETING OF THE ELECTRICAL COMMITTEE OF THE UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION, NEW YORK, MARCH 24 AND 25.

The annual meeting of the Electrical Committee of the Underwriters' National Electric Association was held at the rooms of the New York Board of Fire Underwriters, New York city, March 24 and 25. The first meeting was called to order by F. E. Cabot, chairman, and the rules and suggestions were read in order by C. M. Goddard, secretary. The suggested rules and changes had been prepared in pamphlet form and were made up from suggestions which had been received during the year and also as a result of the deliberations of the sub-committees of the general committee prior to the annual meeting. The first session was opened shortly after 10 a. m., Wednesday, March 24, with nearly fourscore in attendance, this number being considerably increased during the day.

The first matter considered was the report of the committee on circuit-breakers. The report of the committee was amended so as to indicate that where circuit-breakers were of a peculiar design, they should be submitted for special examination and approval before being used.

The discussion of this report dealt principally with the breaking capacity and with section 9*a*. The following rule was suggested for the breaking capacity: "Must successfully operate three (3) times with two (2) minute intervals intervening without incapacitating the breaker, the condition of the testing circuit to be as given in the following table:

Current Rating of Breaker.	Per Cent Voltage Drop in Test Circuit with Rated Current Flowing.	Minimum Available Capacity of Supply System (Not Including Overload Capacity).
0 to 100.....	2	1,000
101 to 300.....	3	3,000
400	4	4,000
500	5	5,000

"Note: No filing of contacts or other repairing of the breaker to be made during the test.
"Multiple breakers must comply with above requirements, whether the tests are made on all poles at once or on any pole individually."

Rule 9*a*, which reads, "Each feed wire from a railway power plant before it leaves the station must be equipped with an approved automatic overload circuit-breaker or other equivalent approved device," was questioned as to whether the feed wires referred to meant four or five wires as one line, and therefore requiring one circuit-breaker, or whether one fuse and two circuit-breakers could be used on a three-phase system.

Section 21 was revised to read, "Excepting on main switchboards, or where otherwise subjected to expert supervision, circuit-breakers will not be accepted for alternating-current motor circuits unless fuses are also provided. For alternating-current motor circuits one side of the line may be protected by a circuit-breaker and the other side by a fuse. This rule applies up to the maximum capacity for which enclosed fuses are approved. For circuits above that capacity circuit-breakers only will be required." This rule was referred to the committee on revision of the Code. The ruling on the breaking capacity was severely criticized, but the chairman stated it was a step in the right direction, and the whole report of the committee on circuit-breakers was adopted.

The next matter taken up at the morning session was the report of the committee on cabinets. This report was adopted after some discussion and criticism of the lack of more definite requirements concerning the design and also regarding the question of spacing between the door and other parts. Provision was also made for the including of metal molding in connection with the linings of cabinets and in connection with composition cabinets.

The laboratory report on flexible cord and cables was adopted. It was suggested that a rule should be incorporated calling for a flame-proof covering. In damp places the braided coverings are to be of thoroughly saturated moisture-proof covering three-quarters of an inch in thickness, and an additional braided waterproof covering over the whole may be required. Portable cord, except in offices, dwellings or similar places, where the cord is not liable to rough usage and where appearance is an essential feature, must meet all the requirements for flexible cord for pendants, and in addition must have a braided cover over the whole. In moist places the outer cover must be saturated with a moisture-proof compound three-sixty-fourths of an inch in thickness thoroughly slicked down, and having an approved filler instead of the extra layer of rubber and two outer braids.

The report of the committee on stage-cable specifications was adopted without discussion, as was also the report of the committee on details of switchboards. Theatre-stage cables shall consist of not more than three flexible copper conductors, each of a capacity not exceeding No. 4 B. & S. gauge, each of which shall be built up of wires not larger than No. 26 B. & S. gauge, each conductor to have a tight, close wind of cotton, or some other approved method must be employed to prevent a breaking strand puncturing the insulation. The conductors are to be twisted together, a filler of approved material being used to make the cable round and to act as a cushion.

It was suggested that the committee on details of switchboards be discharged.

The report of the committee on rule 13a, which was appointed to consider proposed changes in the grounding rule and the question as to whether it should be made mandatory, reported that as they were asked only to make this rule mandatory up to and including 150 volts for alternating-current secondary circuits and to prohibit grounding of such circuits carrying in excess of 150 volts, it is evident that this suggestion cannot be based on the question of the fire hazard, because this hazard is as great from an ungrounded circuit in excess of the 150 volts as from such circuits carrying not over 150 volts. The committee believed that the Underwriters have no right to enforce a rule which cannot be defended on the ground that it is adapted for the purpose of lessening the fire hazard.

Mr. Goddard, the chairman of this committee, stated that the Underwriters were willing to recommend changes in rule 13a, which would cover the life as well as the fire hazard when there was an agreement between the members of the association. From the discussion, it seemed evident that, although some changes in the rule should be made, the subject was not fully covered by the committee's report, especially as systems carrying over 150 volts were not included.

The first business of the afternoon session was the report of the committee on rule 64. This was adopted without discussion, as was also the report of the committee on auto-starters.

The committee on recodification made the following suggestions:

First—That the Code be printed in two parts: (*a*) This part to include Classes A, B, C and E of the present Code. (*b*) This part to include Classes D and F of the present Code.

Second—That fine-print notes be limited to suggestions and explanations, and shall not be considered as mandatory.

Such fine-print notes as are in effect rules are to be printed in regular rule type.

Third—That cross-references be eliminated when feasible, so that the rules will be complete in themselves as far as possible.

Fourth—That proofs of the 1909 edition of the Code, with the above recommendations carried out by the Recodification Committee, be submitted by the secretary to the full committee for final approval.

This will mean that the principal Code will only contain rules and exceptions, and not recommendations which will sometimes apply as rules, and this construction will greatly simplify matters. The report of the committee on recodification was adopted.

The committees on wiring of electric cranes, fans, motors, telephones, switchboard, lighting, variable-speed motors, rule 2a, rheostats and street railways, did not have any reports to offer.

The report of the committee on switches and cut-outs was adopted. In this report the recommendation of the withdrawal of the approval of Edison plug cut-outs for 250-volt service, these cut-outs to be limited hereafter to voltages not exceeding 125 volts, was revised by including three-wire where the neutral is grounded and the potential between outside wires is not above 250 volts. The suggestion recommending that ratings for snap switches be not standardized was omitted.

SUGGESTED CHANGES IN THE RULES.

The action on the suggested changes in the rules was as follows:

The suggestion to strike out Section *d* of Rule 12 was adopted.

The sense of the changes to Section *a*, Rule 12, Section *b*, Rule 12, Section *e*, Rule 12, and Section *g*, Rule 12, but not the wording, was adopted, and the whole matter was left to the committee on recodification.

The addition to Section *b*, Rule 14, reading, "For wires smaller than No. 8 B. & S. split knobs shall be used and tie wires and knobs will not be approved," was adopted.

The second day's session was opened about 10 a. m. Thursday, by continuing the discussion of the suggested changes in the rules.

Rule 26, Section *a*, was adopted, with the following exception to the rule: "Except in straight electric fixtures, where the insulation of conductor and the armor of fixtures are the equivalent of a conduit or armored cable system and where used with approved wireless clusters or where the double-braided wire extends directly into the socket, the insulating joint may be omitted." The wording is to be changed so as to exclude brass shell clusters.

The suggestion to strike out Section *e* of Rule 31A was not adopted.

The suggestion amending the fine-print note of Section *b*, Rule 40, by striking out the reference to Rule 43, was adopted.

The amendment to Section *a*, Rule 49A, was referred to the committee on junction boxes.

The amendment to Section *i*, Rule 49A, was approved. The amendment to Section *c*, Rule 54A, was approved.

The suggestion concerning Section *b*, Rule 55, to change the rating of lamp sockets to volts and amperes for both key and keyless type, was referred to the laboratories.

The suggestion to amend Section *j*, Rule 55, to read as follows: "All insulating material in which any current-carrying and operating parts are mounted must be of porcelain or other approved material."

The new section to be added to Rule 57 to read as follows: "Terminals must be designed to secure a thoroughly good and permanent contact with the supply wires, which contact must not be lessened by the motion of the lamp during trimming," was approved.

The suggestion to amend Section *f*, Rule 60, to read as follows: "Motor-starting rheostats for direct-current circuits must be so designed that the contact arm cannot be left on intermediate segments, and must be provided with an automatic device which will interrupt the supply circuit before the supply of the motor falls to less than one-third of its normal value. In motor-starting rheostats for alternating-current circuits, the automatic interrupting device may be omitted," was approved.

Upon the other suggested changes the committee recommended no action, and this recommendation was adopted.

MISCELLANEOUS SUGGESTIONS.

The miscellaneous suggestions were then taken up:

The suggestion that "rules be adopted allowing change in the relative positions of service switch and cut-out and meters in order to prevent theft of current" aroused some discussion, as the meaning of the section, so that this was referred back to the committee.

The suggestion that a sub-committee be appointed on fixtures and fixture wiring, which request came from various fixture manufacturers, was approved.

The suggestion that a committee be appointed on Rule 12*a* was referred to the conference committee.

The suggestion that the question of flame-proof carrying on wires required by Rule 32 be considered, was referred to the committee on street railways.

The suggestions that requirements be adopted covering installation of wires and cables when passing through any building as feeders to another building; that rules be adopted allowing the use of approved varnished cambric cables of No. 6 B. & S. gauge and upward, and that a committee be appointed on wiring and installation of high-tension motors, was referred back to the committee.

The suggestion that all lamps consuming in excess of 175 watts be equipped with a base so formed that the lamps will not fit sockets or receptacles of lower wattage was referred to the laboratories.

The suggestion that the grounding of metal ceilings to water pipe be required was referred to the National Fire Protection Association.

The suggestions that all metal linings of sockets be of copper and that a ruling be made regarding the wattage of Nernst-lamp glowers, was referred to the laboratories.

The suggestion that self-starters be attached on all alternating-current starters was referred to the committee on auto-starters.

The suggestion that the maximum weight of any consuming device, together with the shade or other special device which would be attached to a pendent flexible cord be fixed, and that there be a rating of wattage for ceiling and desk fans, was referred to the laboratories.

The secretary announced that as the Code was changed every two years, and that as the suggested changes were becoming fewer in number each year, that unless some extraordinary difficulties should arise, the next meeting of the Electrical Committee would be held in March, 1911.

Mr. Wynkoop, of the electrical inspection service of the city of New York, announced that in all probability the 1909 Code would be adopted by the city of New York.

Mr. Goddard announced that changes in rules did not go into effect until printed in either the Code or the Supplement.

THE ELECTRIC GARAGE.[1]

BY S. P. REED.[2]

The maintenance of an electric garage is an absolute necessity in every locality where electrics are sold and used. This is true both from the standpoint of the owner and dealer.

Here is a common story. A man is taken out for a trial trip. As he nears home he expresses his entire approval and says he believes he understands how to operate the machine and to read the meter. He asks the dealer to give the wife and daughter a trial spin. They, too, are enthusiastic, but the deal falls through in the end, not because they are not all anxious and willing to buy the machine, but the man discovers that he will have to charge and care for his own machine. He is wise enough to know that he has no training and the undertaking would prove a failure.

A gentleman in Palo Alto bought an electric for his daughter. He had a fine home garage fitted up and all went so well that he often took the electric to his office in preference to his gasoline car, as it was so much easier to start in the morning, but soon the charging plant developed difficulties, the car was left discharged for a long time, bringing on battery trouble, and eventually the outfit was discarded.

Last year a Menlo Park resident bought an elegant coupé with a complete charging outfit and numerous instruction books, but as there was no one to properly interpret the instructions this outfit, too, was discarded.

Case after case might be cited, all going to prove that the dealer must have a garage in connection with the salesroom, and not encourage the owner in the idea that he can take entire care of his machine. The average owner might charge his own car, but when the difficulties arise, which are sure to come to the amateur, he ought to rely on a competent garage man.

Electric vehicles must not be sold where the owners cannot be in close touch with the electric garage. A man familiar with his own occupation and having his time taken up with it cannot be expected to take up a new occupation and succeed with it, and this is what a dealer asks of his customer when he turns him over an electric with a charging plant and considers the deal closed. Usually all goes well for a short time and the purchaser is enthusiastic. His friends and neighbors watch the new machine with interest and envy, but soon troubles arise which the unskilled owner cannot remedy—troubles which to the expert, were he near, would be little or nothing. Generally they develop into enormities and the electric is classed as a failure by the owner and his friends. This idea is spread in the vicinity and the sale of electrics is often held back in many fields that would be the best with the electric garage to rely upon for assistance.

The electric garage is really a school to teach people the pleasure and benefits of the electrics and to show them how small the troubles really are.

The electric garage is equally a benefit to the owners and the electric vehicle trade. It gives to one a perfect transportation and to the dealer a profitable and satisfactory vocation. The profits are not only from the first sale but from the operation of the garage. The business, especially on the Pacific Coast, has no dull season, electrics being used winter and summer. The electric is the cleanest vehicle made, and the garage is a clean, quiet place.

The location of the garage is an important item. In the largest cities there will be garages in both residential and business districts. In the average town the garage will be half-way between the business section and the residential. The reason for this is easily understood when we consider that the electric is pre-eminently the family car and is fast becoming the most popular machine in this particular field. Each and every member of the family can run the machine for themselves, so these same people must have the garage in a place where all may visit it. It should be on an open street with no street-car lines and little traffic.

The chief attraction of the electric garage must be its cleanliness. The machine itself is clean and its home must correspond. There is no objection to the electric being housed in the vicinity of the most fastidious people. There is no noise, no deafening gasoline explosions, no oil smoke and no greasy floors with the usual expectations of fire.

True, the electric will be delivered where wanted, but as many times as delivered it will be called for by members of the family who will meet friends at the garage, and this brings more customers.

The plans of every garage should include a well-planned reception room for ladies and gentlemen, with especial accommodations for ladies. There have been, up to the present time, very inadequate accommodations at garages and there should be more attention paid to this feature. The ideal reception room will be near the door, not having the interior visible from the street, but it would be well to have glass doors on the showroom side.

The garage, if there is sufficient street space, ought to have an entrance and an exit—entrance on the right and exit on the left. This avoids confusion.

The showroom might well be on the exit side. This for many reasons. When the machines come in they are often muddy and not as presentable as they might be.

The washroom should be as near the door as possible. This saves the floor and prepares the machine for any repairs it may need. If there is no repair it can go at once to its stall in the charging or storeroom.

The charging room occupies the greatest amount of floor space in the garage. There will be no work done on the car in this room; the washroom, tireroom, battery room and repair shop being separate rooms.

When a car is to be kept in a garage it is well to give it a number. This number should be used on every tag attached to the machine, on the charging stall, charging plug, owner's locker, in fact, everything pertaining to that particular car.

There are two approved methods of charging electric vehicles. One might be termed the central or collective, the other the individual.

In the central the readings are all taken at one central station, where is located the generating plant, the switchboard, recording files and rheostats controlling the current to each machine. The instruments should consist of one voltmeter and two ammeters, one ammeter showing the total current, the other showing the individual current, having the bus-bars so arranged that the readings may be taken from any machine on charging. The only readings that cannot be taken here are the acid gravities and the voltages of the separate cells.

In the individual method the rheostats

1. Paper read at first annual convention Pacific Coast Electric Vehicle Association.
2. Reed Electric Laboratory, San Jose.

are placed back of each separate machine and the readings usually taken from the machine meter, though the current may be read from the main switchboard. Both systems have their merits. In both a careful tag system is universally used. On these tags are printed the records for each car. These records must be in detail; not only charging records are made but also records of repairs and performance. These records can be tabulated to prove the success of the electric vehicle and to prevent misunderstandings of accounts and so perform one of the most important details of the garage work.

The source of the power varies in different localities. There is nearly always a local power plant anxious to serve the electric garage, especially if an agreement can be made whereby the garage used most of its current away from the peak of the company's load. This is naturally the time when the garage needs most of its current. The price, for this reason, ought to be less to the garage than to any other consumer. If direct current is supplied, a switchboard with regular rheostats is all that is needed. If the current is alternating, some method of transforming to direct is necessary. For the large loads or periods of large loads a motor-generator set is best. For smaller loads the mercury-arc rectifier is preferable.

In the isolated places the garage may generate its own current, there being on the market at the present time many reliable gasoline generating plants.

There should be rolling tables to take the batteries to the battery room, as it is not a good idea to take the machine where the paint, iron and upholstering will be subjected to the acid fumes.

The battery room as well as the charging room must be in charge of trained and competent men. These men, in fact, must be experts, as they are the mainstay of the electrical garage. The number of men required for each garage is said to be one expert for every twenty-five machines and one boy for delivering to every fifteen machines. There will, of course, be a day and night washer, machinist and a good manager. This with a bookkeeper ought to complete the pay-roll.

The other expenses in the garage will be the rent, insurance and power. The rent averages about $2 per month per machine and the current costs from $5 to $7 per month per machine. The help on the machine is not more than $6 per month.

The receipts for charging and storing average $25 per month. Repairs and sundries are extra. Adding to these sources of income, the profits on sales of new machines, a neat balance can be figured for the garage owner.

Interurban Facilities at South Bend, Ind.

The issue of the South Bend *News* of March 21 devotes an entire section to descriptive matter concerning the electric railways and electric-light and power equipment located in that city. It is stated that in the development of South Bend no one factor has contributed more to its success than the interurban railways, and in this connection it says it is interesting to note that the first electric street-car line was put in operation in that city.

The South Bend Street Railway Company was organized in 1873, the incorporators being John R. Foster, Jacob B. Arnold, Jr., Jacob Woolverton, Alexis Coquillard and Henry B. Hine. The first franchise was granted to the company by the City Council in 1880; Lucius Clarke, promoter, and Charles Vanderpoel were the two men associated with the incorporators, responsible for the adoption of electricity. In 1882, working under the franchise granted, the use of the overhead trolley system was added, but the cars could only be moved for a block at a time, when they would come to a stop because of failure of the power.

While this was not considered a success, the promoters did not give up hope, and following the building of the line to Mishawaka by the South Bend & Mishawaka Railway Company, a consolidation which proved very profitable was effected. The Indiana Railway Company was organized in 1899 with Arthur Kennedy, president, and J. McM. Smith, vice-president and general manager. This company became the owner of the lines in South Bend and Mishawaka and the construction of the line to Elkhart and Goshen soon followed. Soon after a line was built by the Indiana company to Laporte and Michigan City. In 1906 the Northern Indiana Company, as it was then known, sold the biggest share of its holdings to the Murdock syndicate, the name of the new company being known as the Chicago, South Bend & Indiana Railway Company.

The lines radiating out of South Bend reach probably more delightful spots in a short time than any other interurbans in a wide radius. Among these are Lake Michigan, Hudson Lake, Chain Lakes, Spring Brook Park, Pine Lake, Silver Lake, Clear Lake and Winona Lake. The Chicago, Lake Shore & South Bend Railway over the "South Shore Route" makes the trip to Chicago from Oliver in three hours. There are trains to Michigan City, New Carlisle, Hudson Lake, Gary, East Chicago, Indiana Harbor and Hammond. Not only is there an extensive and profitable passenger service, but there is also a fast express and freight service at convenient hours. The Winona Interurban Railway operates between Warsaw, Ind., and South Bend, making connections at South Bend for Niles, St. Joe, Benton Harbor, Michigan City and Chicago.

Any reference to electric service in South Bend would be incomplete without calling attention to the service of the Indiana and Michigan Electric Company. This company is the consolidation of the South Bend Electric Company, the Elkhart Electric Company, the Chas. A. Chapin Light and Power Company and the Berrien Springs Power and Electric Company. The company started operations in August, 1907, and has several dams and a hydroelectric development on the St. Joseph River, a steam plant at Mishawaka, ten substations, and transmission lines connecting up Laporte and South Bend, Elkhart, Niles, Buchanan, Berrien Springs, Benton Harbor and a number of other smaller places. The president of the company is Charles A. Chapin, with F. A. Bryan, general manager and L. B. Andrus, general superintendent. In addition to an extensive city and residence lighting system the company is supplying the greater part of the city's industrial power requirements. Among the long-time and well-satisfied customers are the South Bend Watch Company, South Bend Chandelier Company, South Bend Spring Wagon and Carriage Company, South Bend Brick Company, Folding Paper Box Company, Folsom Manufacturing Company, Smith & Jackson Lumber Company, Malleable Steel Range Manufacturing Company, Muesell Brewing Company, Perfection Mattress Company, George Cutter Company (manufacturing the well-known Cutter specialties), Hibbard Printing Company, South Bend *Tribune*, Thomas Stoudt Rolling Mills, South Bend Chilled Plow Company, Studebaker Brothers Manufacturing Company and Mishawaka Woolen Manufacturing Company.

QUESTIONS AND ANSWERS.

LOADING OF THREE-PHASE GENERATORS.—Please answer the following questions relative to two three-phase alternators, one connected up star and the other delta: 1. If the load on each becomes unbalanced and one phase has no load at all, would there be current flow in all of the three wires? 2. Would there be current in each of the three windings on the armature? 3. If the load shifted till but one phase was loaded, the other two carrying no current at all, will any of the three wires be dead? 4. Will any of the windings be dead? 5. With no current in any phase, would the three voltages react and produce zero so that there would be no current in any of the windings? The alternators could be considered as carrying a load of lights direct. —M. R. B., Chicago.

In answering these questions it is assumed that each generator supplies current to three sets of lamps connected to the respective phases; to cover all possible arrangements with three wires the lamps will be assumed to be connected (a and c) delta at first and then (b and d) star to the three main wires. (1, a) Lamps delta on a delta generator, with one phase out, produces current in each wire, but (2, a) no current in the armature winding corresponding to the open phase. (1, b) Lamps star on a delta generator, with one phase out, produces no current in the corresponding main wire, and (2, b) no current in the adjacent armature windings. (1, c) Lamps delta on a star generator, one phase out, produces current in each main wire and (2, c) current in each armature winding. (1, d) Lamps star on star generator, one phase out, produces no current in corresponding wire and (2, d) no current in corresponding winding. 3, 4. None of the wires or coils will be dead as long as electromotive force is generated in the latter, but the wires or coils may not be carrying a current, as follows: (3, a) No current in the intermediate wire and (4, a) no current in the two coils corresponding to the open phases; (3, b) no current in any wire nor (4, b) in any coil; (3, c) no current in intermediate wire nor (4, c) in intermediate coil; (3, d) no current in any wire nor (4, d) in any coil. 5. With each generator running on open circuit no current should flow in the windings, because in the delta-wound machine the internal electromotive forces counterbalance each other, and in the star-wound machine there are no closed internal current paths.

ROTARY CONVERTER WINDINGS.—Please show me a diagram of the wiring of a rotary-converter armature. Can one use the same winding for both direct and alternating currents with the commutator on one side and the collector rings on the other? Would it be possible to use one-half the windings for alternating current and all for direct current, or *vice versa?* —W. L. R., Burlington, Iowa.

A simple diagram and description of the rotary converter is given on pages 348 and 349 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 20, 1909. Note that there is but one winding, as you suggest in your first question; that in regular operation this winding is fed with alternating current from the collector rings, and this is rectified by the commutator into direct current. A correct understanding of the winding of a rotary converter will show that the last question is impossible of fulfilment.

SPEED OF MOTOR-TYPE WATTMETERS.—In a shunt motor increasing the field current causes the motor to run slower. In a recording wattmeter, however, increasing the current in the fields seems to cause it to run faster. Kindly explain this for me.—K. C. McD., Charlestown, Mass.

In a shunt motor strengthening of the field current causes first an increase of counter-electromotive force, which results in a decrease of armature current and of torque with a consequent reduction of speed. In a recording wattmeter of the motor type the armature is a part of the pressure circuit of which almost all the potential difference occurs over the resistance in series with the armature. Consequently an increase of counter-electromotive force in the armature, due to a strengthening of the field current, has but very little effect on the armature (pressure circuit) current. Therefore strengthening of the fields produces an increase in torque and consequent increase in speed of the armature.

TEST OF ELECTROLYTIC RECTIFIER.—I made an electrolytic rectifier which I do not think gives the rectified current. Would like to know how to test it. Several ways I have tried have not proved conclusive.—C. O. S., Los Angeles, Cal.

If a good direct-current ammeter having a permanent magnet and moving-coil movement and having a range about equal to the alternating current used is available, insert it in the direct-current circuit. A steady reading of the needle will indicate that direct current is produced; a continual quivering or zero reading will show that the current is not rectified. Or use an electrolytic cell containing a solution of copper sulphate or copper cyanide; connect the direct-current terminals to two carbon rods and insert these rods into the solution. If direct current is passing for some time, a deposit of copper will be found on the carbon connected with the negative terminal; if alternating current is flowing no deposits will be found.

KILOVOLT-AMPERE AND POWER-FACTOR.—What is meant by kilovolt-ampere and by power-factor? What is meant when the volts are not in phase with the current? How are carbon brushes copper-plated?—L. M., Chicago.

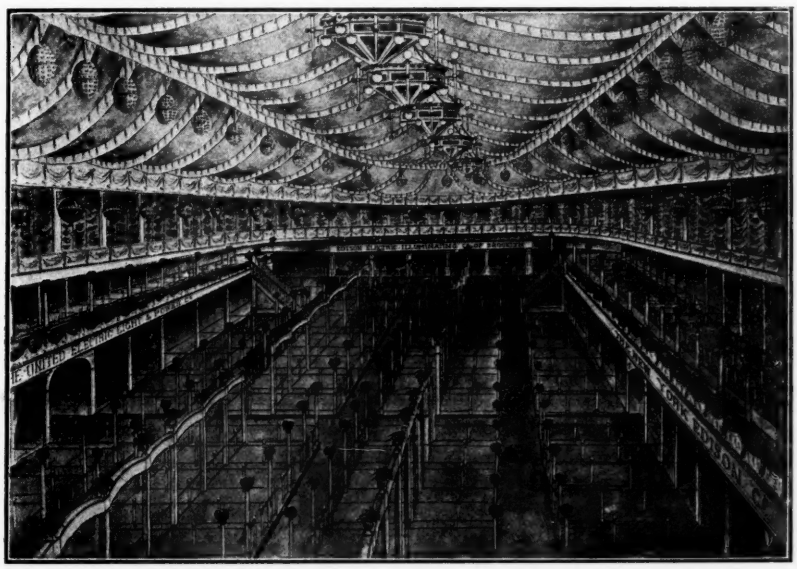
A kilovolt-ampere is the apparent power in an alternating-current circuit, the product of whose voltage and amperage equals 1,000. It is ordinarily found by multiplying the volts and amperes and dividing by 1,000. It takes no account of power-factor; but when the kilovolt-amperes are multiplied by the power-factor the product is the true power of the circuit expressed in kilowatts. The power-factor is the ratio between the true power in watts and the apparent power in volt-amperes, or between the kilowatts and the kilovolt-amperes; it is equal to the cosine of the angle of lag or lead. When an alternating-current circuit contains capacity, such as condensers, or inductance, such as choke coils, arc lamps and motors, it is found that the impressed electromotive force does not rise and fall at the identically same instant that the resulting current rises and falls; in the case of capacity the current leads the electromotive force, while with inductance the current lags the electromotive force, the angle between the two being in each case called the phase angle or the angle of lead or lag. For copper-plating carbon brushes, prepare a plating solution containing to a quart of water, 2.5 ounces pure cyanide of potassium, 1.25 ounces carbonate of copper and 0.5 ounce carbonate of potassium; dissolve each separately first, then add the second solution to the first one mentioned, and finally add the third, stirring the mixture thoroughly. Connect the brush to the negative side of a low-voltage, direct-current circuit and suspend it in the liquid; on either side of it and about two inches away place a copper plate and connect these plates to the positive side of this circuit. The carbon must be clean and free from grease before attempting to deposit on it.

William McAdoo, of the Hudson & Manhattan Railroad, announced on March 28 that beginning March 31 the rear car on all trains would be reserved for women in rush hours.

Third Annual New York Electrical Show.

Active preparations have already begun for the New York Electrical Show, to be held in Madison Square Garden next October. Every effort is being exerted by the management to make it the finest exhibition of the kind ever given. The decorations, illumination and general arrangement of the exhibitors' spaces will be distinctly novel, and the whole interior will present a uniform appearance.

A new departure has been inaugurated this year whereby the space sold to exhibitors will include decorations and current for lighting. This will relieve the manufacturers from much detail work, and make it necessary only to install and remove the apparatus shown.



SUGGESTED ARRANGEMENT OF BOOTHS AND SCHEME OF DECORATIONS FOR NEW YORK ELECTRICAL SHOW, MADISON SQUARE GARDEN, NEXT OCTOBER.

Especial attention will be given to working industrial exhibits, and there will be a great display of electrically operated machinery representing many classes of manufacturers.

Presentation of the John Fritz Medal.

The John Fritz Medal for 1909 has been awarded by the Board of Award, specially selected for the purpose and consisting of four members of each of the national engineering societies, to Charles T. Porter, honorary member of the American Society of Mechanical Engineers, for his work in advancing the knowledge of steam engineering, and improvements in engine construction.

The public ceremony of the presentation of the medal to Mr. Porter will take place in the large auditorium of the Engineering Societies Building, in New York city, at 8:30 p. m., on Tuesday, April 13, 1909. It is the wish of the board to give distinction to the event, and to make these awards year by year memorable and fittingly conspicuous.

The meeting is open to engineers from all brances of the profession, and particularly of those represented in the four national organizations of engineers participating in the creation of the medal fund. Besides the simple ritual of the presentation of the medal, in the presence of invited guests and distinguished representatives of engineering, there will be the following addresses by representatives of the four groups of the profession most concerned:

"The Debt of Modern Industrial Civilization to the Steam Engine as a Source of Power," by Dean W. F. M. Goss, of the University of Illinois.

"The Debt of the Modern Steam Engine to Mr. Charles T. Porter," by Prof. F. R. Hutton, of Columbia University.

"The Debt of the Era of Steel to the High-Speed Steam Engine," by Robert W. Hunt, of Chicago.

"The Debt of the Era of Electricity to the High-Speed Steam Engine," by Frank J. Sprague, of New York.

The board will be gratified by a large and representative gathering to do honor to the donor, to the recipient, and to the great achievements which the John Fritz Medal is intended to commemorate.

Arrangements are being made by a committee composed of Henry R. Towne, chairman, Chas. Kirchhoff, Chas. W. Hunt, S. S. Wheeler and F. R. Hutton.

Programme of the Missouri Association Convention.

The Missouri Electric Light, Gas and Street Railway Association will hold its third annual convention at the Colonial Hotel, Springfield, Mo., on April 15, 16 and 17. Ample provisions have been made for the comfort and entertainment of those who will attend the convention. Great care has been bestowed on the arrangement of the programme of papers and it is believed that those to be presented will be of such general interest as to insure a large attendance. The programme is as follows:

Thursday, 10 a. m.—Address of welcome and response by the president; president's annual address to the association; executive session. 1:30 p. m.—"Insurance on Public-Service Plants," by C. W. Hough; "Records," by P. A. Bertrand; "The Tungsten Lamp from the Central-Station Manager's Standpoint," by Paul J. M. Loewe.

Friday, 9:30 a. m.—"Equitable Rate-Making," by C. W. Hough. 1:30 p. m.—"The Value of an Engineering Experiment Station," by Prof. H. B. Shaw; "Some New Features of High-Tension Transmission," by O. Wiemer. 7:30 p. m.—Banquet.

Saturday, 9:30 a. m.—"Office System and Accounting," by W. J. Cunningham; "Building Up the Day Load," by E. L. Callahan. 1:30 p. m.—Executive session and adjournment. 3:30 p. m.—Visit to the plant of the Springfield Gas and Electric Company.

The president of the association is W. B. Hays and the secretary and treasurer is C. L. Clary, of Sikeston, Mo.

Chicago Electric Club.

At the meeting of the Chicago Electric Club on March 24 Judge Frederick L. Fake delivered an address on points of particular interest in connection with crime, the law and the courts. The meeting on March 31 was addressed by Prof. A. A. Radtke on the subject, "Public-Service Commissions."

Paris Strike Over.

The strike of the employés of the Department of Posts and Telegraphs has come to an end, and telegraphic communications are now normal with all parts of France and neighboring countries. For nearly a week there was an almost complete standstill of both postal and telegraphic communication.

The New Electrical Laboratory Equipment of the City of Philadelphia.

The electrical department of every large city has occasion to purchase and pass on a great quantity and large variety of electrical materials. This makes it important that a city should be provided with well-equipped laboratories for measuring and testing such materials. The city of Philadelphia is in advance of most of the other cities of this country in this respect, inasmuch as it has recently provided an excellently equipped laboratory for this purpose. A little consideration of the electrical interests of any large city emphasizes the importance of such a laboratory.

In Philadelphia the lighting problem of the City Hall alone is a very large one. The exterior of this impressive building is well and tastefully lighted by clusters of incandescent lamps, shielded by opalescent globes, mounted on decorative bronze pillars. The 500-foot tower is encircled at its top by a rim of powerful arc lights that may be seen at a distance of twenty miles, while at a slightly lower elevation is placed an enormous clock which is lighted so well by banks of small lamps that the time may be read at night some two or three miles away. In addition to this, the Electrical Bureau has charge of the entire street lighting of the city, which extends east and west about eight miles, and north and south twelve miles.

The extensive fire-alarm and police telegraph and telephone system is also under the charge of this bureau. The central station of this system is in the City Hall. There are consequently centred there some 1,800 wires, by the means of which the police and fire departments are in communication with all parts of the city.

The effective lighting of the City Hall, as well as the excellent condition of all of the electrical work, is due to the untiring energy and progressiveness of the chief of the Electrical Bureau, James F. McLaughlin, and to him also is due the equipment of the electrical laboratory. The instruments of this laboratory were all furnished by the Leeds and Northrup Company, of Philadelphia, and may be conveniently described under the following headings:

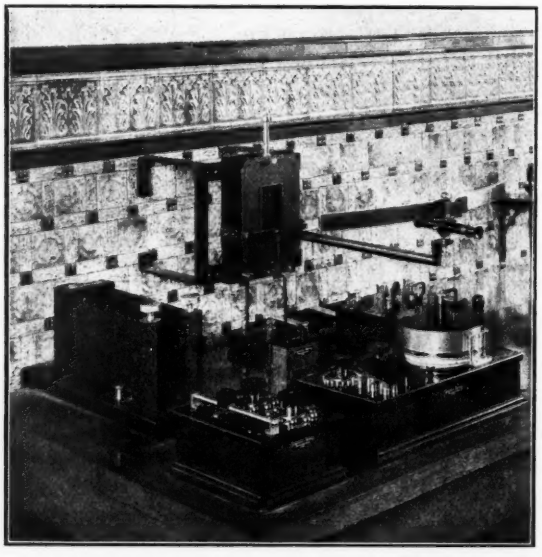


FIG. 1.—APPARATUS FOR VOLTMETER AND AMMETER CALIBRATION, PHILADELPHIA CITY LABORATORY.

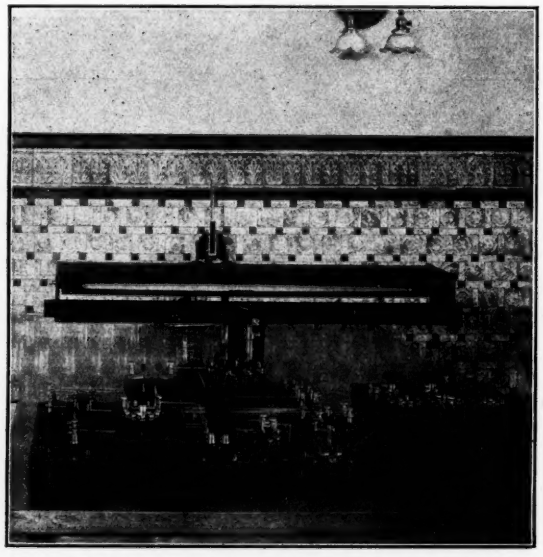


FIG. 2.—CABLE-TESTING APPARATUS, PHILADELPHIA CITY LABORATORY.

PHOTOMETRIC APPARATUS.

The photometric apparatus consists of a three-meter photometer with a complete equipment of accessory apparatus for measuring the candlepower of incandescent lamps. The photometer is provided with a direct-reading scale and with a Lummer-Brodhun photometer screen. It is also equipped with a universal rotator which makes it possible to measure the candlepower of incandescent lamps when rotating in any plane with reference to the line of sight. With this apparatus distribution curves can also be readily determined for any style of lamp.

AMMETER AND VOLTMETER STANDARDIZATION EQUIPMENT.

This comprises a complete equipment for the accurate measurement of direct-current electromotive forces from a very small fraction of a volt up to 1,500 volts and for the measurement of currents from a milliampere to 300 amperes. Referring to Fig. 1, the instruments are shown ready for a test. They are a Leeds and Northrup potentiometer (which measures electromotive forces from the lowest voltage up to fifteen volts), a volt box or multiplier for extending the range up to 1,500 volts, a set of standard low resistances for measuring current, a Weston standard cell and a type H wall D'Arsonval galvanometer.

LABORATORY CABLE-TESTING APPARATUS.

The cable-testing equipment is shown to the left in Fig. 2 and contains all of the necessary instruments for measuring the capacity, insulation and conductor resistance of cables. Capacity is measured by the ballistic-throw method, and insulation by the direct-deflection method, as is customary in the laboratories of cable-manufacturing plants. The instruments are a high-sensibility galvanometer, a lamp and scale, standard one-tenth megohm resistance, standard one-third microfarad condenser, Ayrton shunt, Kempe key, battery and galvanometer reversing switches, short-circuit key and other keys and switches for interchanging connections. The form of galvanometer used has been found very satisfactory for this class of work on account of its quickness of action and accessibility of its parts, combined with its high sensibility. The lamp stand and scale is one metre long and is of the type in which the scale is read by reflection from a mirror. This type

is much more satisfactory than that requiring the light to come through a translucent scale, as the spot is equally visible whether the observer is directly behind it or not.

It will be noted from the illustration that the arranging of the instruments provides the best possible insulation, and, at the same time, connections that are perfectly obvious. The instruments are all mounted on a polished hard-rubber plate. The binding-posts and many of the parts of the instruments are mounted on petticoat-insulated pillars. Connections between the instruments are made by means of heavy nickel-plated wires, stiff enough to hold their shape and to be run in the air, which insures perfect insulation and a scheme of connections which can be readily traced. The arrangement of switches, etc., is one which has been found most satisfactory from the operator's standpoint. To interchange connections so as to change from capacity to insulation tests, it is only necessary to throw a few double-throw switches.

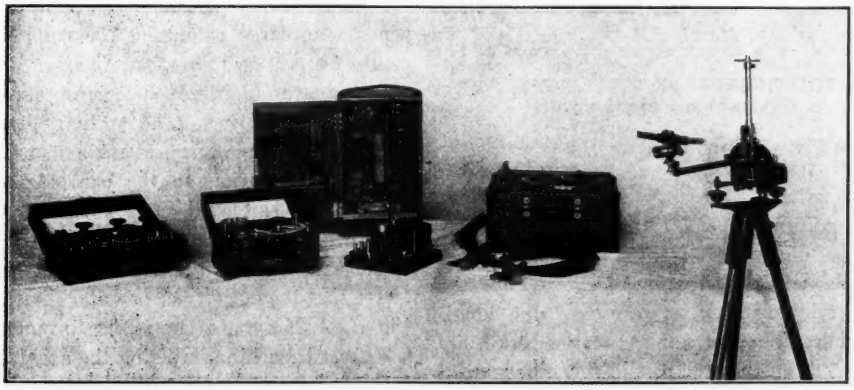


FIG. 3.—PORTABLE CABLE-TESTING SETS FOR THE PHILADELPHIA CITY LABORATORY.

To the right of the insulation and capacity-testing set is a five-dial Wheatstone bridge for resistance measurements from a small fraction of an ohm to a few megohms. The dial construction of this bridge makes it exceedingly convenient to use without any sacrifice of accuracy due to poor contacts. The galvanometer, lamp and scale and Ayrton shunt of the insulation and capacity-testing set are so arranged that they may be used with the Wheatstone bridge.

PORTABLE CABLE-TESTING SETS.

The above-described insulation-testing set can be used only for testing cables which can be either brought into the laboratory or connected to it by means of other wires. There are frequently occasions to make tests on cables where this is not possible, and a set of portable testing instruments is therefore also provided. The instruments for this purpose are shown in Fig. 3. Beginning from the left to the right, these are:

1. A Leeds and Northrup dial decade portable testing set for measuring conductor resistance and locating faults by means of the Murray and Varley loop tests.

2. A Leeds and Northrup fault finder for making the same measurements. This instrument is particularly adapted for measuring faults in cables where wires are in pairs, as in telephone cables, and is so simply arranged that linemen, without technical education, can readily learn to do excellent work with it. It is also an excellent instrument for locating opens.

3. A portable telescope galvanometer, an instrument with which insulation resistance may be tested up to 200 megohms. For its range of measurement, it is a remarkably light and convenient piece of apparatus.

4. A bridge for locating faults in power cables and other cables of large cross-section. It will be noted from the illustration that it is provided with large extension cables and large clamps, by means of which errors due to connecting leads and imperfect contacts are eliminated. On account of the large cross-section in the class of cables for which this bridge is intended, it is very important to avoid these errors.

5. This is a high-sensibility galvanometer, mounted on a tripod for street use. In combination with the 100,000 ohms, the Ayrton shunt and the standard condenser, which are shown in the carrying case in the back of the picture, this instrument is used for insulation and capacity tests. The galvanometer is provided with a special device to minimize the influence of vibrations, which is so successful that it is practical to use the instrument even in places where the ground is in continual vibration, due to heavy traffic or other causes.

Long Island Railroad to Spend $2,000,000 for Equipment.

The Long Island Railroad Company is asking for bids on 130 steel passenger motor cars, which, with the motors, will cost about $2,000,000. These cars are for service through the Pennsylvania tunnels into the New York city terminal, which the Pennsylvania Railroad is now completing. Only steel cars are to be run through these tunnels, and the Long Island Railroad is bringing its equipment up to the requirements of the new service.

The Long Island road some time ago ordered fifty similar steel motor cars from the American Car and Foundry Company, and these are now in service on the suburban lines, being run in the steam trains from Long Island City. The cars now being tried out are being run without the motors. It is expected that the new cars will be similar in all respects to the steel cars now in use. Officials of the Long Island Railroad say that these cars are giving entire satisfaction. The cars are fifty-three feet in length, fitted with transverse seats in the body of the cars, with long side seats at both ends of the cars, so that there is much free room at both entrances. The cars are vestibuled and fitted with broad steps to facilitate entrance and exit.

The Long Island Railroad has laid out its own improvements and its recent additions to its equipment with a view to the traffic conditions which will prevail upon the completion of the Pennsylvania terminal improvements and its tunnels under the North and East rivers.

New York City Independent Telephone Company.

Justice McLean, in the New York Supreme Court, denied the application of the New York Independent Telephone Company for a peremptory writ of mandamus demanding the Commissioner of Water, Gas and Electricity to issue to it a permit to use the conduit of the Empire City Subway Company from Wall Street to Hanover Street, New York city.

The annual meeting of the New York Independent Telephone Company will be held at 120 Broadway, New York city, April 7, at 12 o'clock noon.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

ALTERNATING-CURRENT TELEPHONY.

An article on this subject was recently published in the *Elektrotechnische Zeitschrift* and abstracted in the ELECTRICAL REVIEW. Fr. Weinberg, of Washington, D. C., comments on this article and states that he has worked in the same field, and his experiments have shown that alternating currents afford the only solution for transatlantic cable telephony. His experiments have demonstrated that the high-frequency alternating current serving as a carrier of telephone currents can easily be brought into resonance with the conducting system by a self-induction inserted in the circuit, and that in this case the weak undulations of the telephone currents, which are otherwise destroyed by the capacity, can be distinctly transmitted. In 1907 he succeeded in transmitting feeble current undulations of frequencies of 3,500 to 4,000 per second over an artificial conductor possessing the electrical properties of an Atlantic cable (10,000 ohms, 500 microfarads). Later experiments have confirmed these results, and the author is convinced that it is possible, by means of high-frequency currents and without any further arrangements, to send telephone currents through an ocean cable, the electrical properties of which have been brought in resonance with the sending and also receiving systems by means of self-induction.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), February 18.*

UNIT OF LIGHT.

At the council meeting of the International Electrotechnical Commission last October, the question of an international unit of light was brought forward by the French Electrotechnical Committee. The proposition of the French delegates was, however, adjourned in order that the electrotechnical committees in the different countries might have an opportunity of further studying the subject. The council also recommended that the committee in each country should endeavor to arrange matters in such a way as to satisfy the needs of both the gas and electrical industries. Considerable progress has been made in England, and the British committee has now appointed a subcommittee, under the chairmanship of Dr. R. T. Glazebrook, to go fully into the details of the question. Dr. Glazebrook will be assisted by Dr. S. P. Thompson (British delegate to the commission), Prof. C. V. Boys (as official representative of the "Gas Referees"), and J. W. Helps (officially nominated by the Institution of Gas Engineers). With the cordial co-operation of the gas industry thus obtained, it is hoped that the subcommittee may be in a position to report at an early date, especially in view of the experiments lately carried out at the National Physical Laboratory, which point to the probability of an eminently satisfactory solution.—*Abstracted from the Electrical Engineer (London), March 5.*

TRANSMISSION OF TIME SIGNALS BY WIRELESS TELEGRAPHY.

Lieut. C. Tissot proposes the use of wireless telegraphy for determining the longitude at sea. The determination of longitude depends on the knowledge of the difference in time between a given place, as the situation of a vessel and the meridian taken as origin of the longitudes. The correctness of the result depends on the exactness of the astronomical observation furnishing the time of the place, and still more on the regularity of the chronometer indicating the time of the first meridian. A wireless transmitting station could send out signals at certain times and inform the vessels equipped with receiving apparatus of the time at the first meridian. In order to make the method really useful the receiving devices should be very simple, so that they can be used by inexperienced hands, and the transmitting station should be capable of sending a considerable distance. Lieutenant Tissot has ascertained that the signals from the Eiffel Tower are regularly received in the entire western part of the Mediterranean, and thinks that it might be utilized for sending the time signals. He has made tests between the Eiffel Tower and Brest under conditions such as are met in practice, in which the signals were received by a simplified electrolytic detector by inexperienced persons. The observations furnished evidence of the absolute state of the chronometer on board. By comparison it was ascertained that the observations coincided with those at the Brest Observatory, and the variations were not more than one-half second. When it is stated that four seconds of time represent one equatorial mile, it will be seen that the approximation of the method is amply sufficient for practical purposes.—*Translated and abstracted from La Revue Electrique (Paris), February 28.*

THE KOTYRA KEYBOARD PERFORATOR.

In handling large amounts of traffic on a single conductor the Wheatstone automatic system still retains a pre-eminent position in wire telegraphy. The successful working of a Wheatstone circuit depends to a large extent on the employment of expert operators for preparing the slip by means of which the messages are signaled to the line. The ordinary line punching demands a considerable amount of physical exertion on the part of the telegraphists employed on this portion of the work, and after a few hours of continuous perforating, the strain becomes so severe that the output per operator diminishes. M. Kotyra, of Paris, has invented a keyboard machine, utilizing the existing Wheatstone perforator. The mechanism is so arranged that a keyboard is made to actuate three electromagnets, the armatures of which communicate the necessary number of blows to the keys of the Wheatstone perforator in accordance with the character selected on the keyboard. In fact, the electromagnets simply take the place of the perforator, which, in the case of the ordinary hand perforator, has to make one stroke for each signal, whereas, with the Kotyra, the depression of one of the keys on the keyboard causes any required character to be perforated. The apparatus consists of two essential parts, the electromagnets and the keyboard. The former are mounted side by side on a framework of metal, which is designed to accommodate an ordinary Wheatstone perforator immediately beneath it. Three brass rods, one fixed to each armature, project below the coils forming the electromagnets, and when at rest they abut on the space, dot and dash keys, respectively, of the perforator. The depression of an armature gives a

smart blow, which is communicated to the respective key of the perforator, and a space, dot or dash signal is punched. A pinion, driven by an electric motor, is supported on a base, and runs at a right angle to and beneath the whole of the keys. Each key has a lever connected to it on the under side of which is a rack. When a key is depressed the rack engages in the pinion, and the lever disengaging itself at the end of its travel is, by means of a spiral spring, returned smartly to its position of rest. The key is then permitted to rise back to its normal position. A contact spring is fitted to each lever, and this spring passes through a series of metallic studs fitted in the base of the machine. These studs are electrically connected to one or the other of the electromagnets in such manner that the circuit is completed each time the spring comes in contact with the stud. Simultaneously one of the perforating keys receives a smart blow, and this records a space, dot or dash. The British Post-Office has Kotyra machines fitted for punching eight slips and has also one twelve-slip machine. The apparatus is also used by some of the submarine cable companies.—*Abstracted from the Electrical Review (London), March 19.*

MEDICAL IONIZATION; ITS USE AND POSSIBILITIES.

N. F. Finzi, medical officer to the electrical department of the Metropolitan Hospital, medical officer to the X-ray department of the German Hospital, and radiographer to the Hospital for Epilepsy and Paralysis, in London, England, in a paper before a recent meeting of the Æsculapian Society described some very satisfactory results which he had secured in treating various forms of virulent skin diseases and diseases of the bones by electrical cataphoresis. By medical ionization is meant the introduction of ions of different sorts into the tissues of the human body. Dr. Finzi explains that when metallic salts and other substances are dissolved in water a portion of the salt is split up into its component parts, each of these parts carrying an electrical charge; the acid radical carrying the negative charge and the basic radical a positive one. These minute particles are known as ions. It is further explained that the ions of any one substance always carry the same quantity of electricity, and that the charge is the same for all bodies of the same chemical valency or combining power, and varies directly as its valency. The splitting up of the salt is more complete the more dilute the solution, but up to a certain point there are more ions present in a strong solution, as, though the proportion of ions to the complete portion is less, there is more of the salt present to be ionized. After a certain concentration the quantity of ions does not increase. Ionized particles of material do not have the same properties as the same substance without an electrical charge. This substance ordinarily consists of uncharged atoms or molecules, and they bear more resemblance in their properties to solutions of the compounds which contain them in the combined condition. Thus chlorine ions have no resemblance to chlorine in its ordinary state, but resemble it as it exists in chloride of sodium solution, in which, of course, it is chiefly in the ionic state in combination with the sodium ions. In introducing ions into any portion of the body, it is necessary to have a thorough understanding of the resultant action in combination with the constituents already latent in the affected parts. In some cases the material is readily precipitated; in others it only enters into the subcutaneous tissues, while in other cases it is readily driven into the most deeply seated parts. The general practice of introducing ionized particles into the human body is to use some form of flexible electrode of certain diameter, moistening the electrode at the point of entry with that solution the ions of which it is desired to introduce, and locating another electrode with some other solution at another point on the body. Theoretically, the passage of current from electrode to electrode starts up a circulation of the ions, according to the material used and the characteristics of the current flowing the salts are introduced into the affected parts. Medical ionization may be used for its general effects or for local effect, or for both. For purely general effects oral administration of a drug ionized as much as possible by being dissolved in a large quantity of water will, on account of its simplicity, be generally used. The local uses are most important and fall into two classes—the action on the skin and that on the deep parts, such as joints, muscles and tendons. The general effects of the oral administration of the drug and the introduction of ionized drugs are pretty much the same, but the ionized drugs act more slowly, and continue acting much longer, owing to their being only gradually disengaged from the combinations which they form in the tissues into which they are driven. A careful technique is most important. All greasy applications must be carefully removed or all of the current will pass through the small patches of surface which have escaped the grease, and electrolysis of the skin will follow. The electrode must press firmly and evenly on the surface, and for this purpose a great thickness of absorbent cotton saturated with a solution to be employed and a metallic electrode of as flexible a nature as possible must be used. Gold or platinum would make the best electrodes, but they are too expensive. The next best electrode is tinfoil, on account of its flexibility, its comparative cheapness and the difficulty with which it is chemically attacked. If the skin is broken, its resistance is diminished and the current becomes very dense at the abrasion. Excessive density will, after a time, damage it. The current is supplied from batteries or from a continuous-current main and regulated by a shunt rheostat, from which the voltage can be varied from 0 to 80. The current must be turned on and off very gradually, as it is the increase and decrease of the current strength that causes pain. It will be remembered that some substances must be introduced at each pole. Plain water must not be used, as the high voltage required or the hydrogen and hydroxyl ions are very irritating. When only the effect of one ion is required, some innocuous substance, such as chlorine or ammonium, is introduced at the other pole. The amount of current that can usually be borne without serious discomfort is about one milliampere per centimetre of the periphery of the electrode, or the surface covered by the electrode.—*Abstracted from the Lancet (London), March 13.*

Pure Tape for the United States Army Signal Corps.

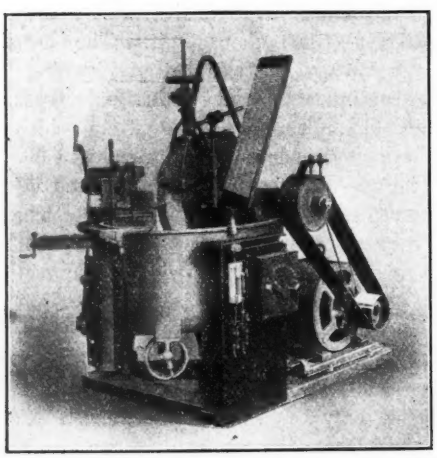
The Signal Corps of the Army from time to time makes purchase of a pure rubber tape for use in the splicing of cable. Some difficulty has been experienced in securing the satisfactory article, which, generally speaking, is to be pure rubber, three-fourths-inch strip on cambric, thickness of rubber about 0.0235 inch, in one-half-pound rolls. The rubber is to be a sheet-cut product and must possess great resiliency, a two-inch piece to be capable of stretching five to six inches without breaking.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Automatic Tool-Grinding.

Perhaps nothing is a better indication of the progress which is being made in the organization of machine shops than the development of tool grinders, from the old form of soft grind-stone running at a slow speed, up through the higher speed emery wheel, to the present automatic tool-grinding machines. The advantages of doing work by a definite system instead of in a haphazard manner, is well understood, and the production of interchangeable parts is the result. But the standardization has gone further than



AUTOMATIC TOOL GRINDER.

to the finished product and now includes the tools used in the machines.

Until recently it has been customary for each workman to grind his own tools, and the result was more or less of a success, according to the skill and knowledge of the workman. A natural step in advance was the employment of one or more men to do the work of sharpening of the tools. This was naturally made much easier with the introduction of a tool-room and checking system of supplying the tools, but many workmen still preferred to grind their own tools, and it is easy to see that there would be some reason for this when a workman is particularly skillful. With the perfection of a machine to grind the various tools that are used on planers, lathes, boring mills, shapers, slotters, etc., in fact, practically all the machines used in machine shops, and one which will do it automatically and accurately, a great stride has been made toward uniformity of tools, and hence maximum production from the machines.

Such a machine has been designed and placed in the market by Wm. Sellers & Company, and has proved by actual work in machine shops that it will do the work better than it can be done by any other method. It is first necessary to adopt standard forms and cutting angles for the various tools and then every tool ground thereafter will conform to the standard which has been found to be the best suited to that work.

Illustrated herewith is an electrically driven universal tool grinder which will grind all kinds of cutting tools except those with concave curves and re-entrant angles less than a right angle. As shown, it is driven by a 7.5-horsepower, direct-current, constant-speed, type S Westinghouse motor, running at 975 revolutions per minute. The motor is mounted on the sub-base of the grinder, and a starting rheostat with fuses and switch is also mounted by the side of the machine, resulting in a very compact and convenient equipment.

With the grinder the company supplies a set of tools which it has found from experiment to be best designed for various classes of work, but provision is also made so that any form of tool, within the limitations of the machine previously mentioned, can be ground correctly to the standard adopted. It is to be noted that this machine is operated successfully by unskilled labor because of the automatic feature by which shapes are accurately duplicated both rapidly and reliably.

A rotary pump forces water to the tool being ground through a system of jointed pipes ending in an adjustable nozzle, furnishing a large volume of water at a low velocity. This arrangement is so made as to prevent the water from splashing and to keep it away from the working parts.

With the machine is supplied a table which shows the adjustments for various tools, so that it is very simple for an unskilled operator to learn to do all the grinding of the cutting tools.

The "Tungstolite" Arc Fixture.

As a means to combating gas competition and improving the service of customers, the tungsten lamp has firmly established itself, and with the advent of the so-called tungsten arc fixtures the electric-light managers secured a very effective weapon for fighting gas competition or giving dissatisfied customers more effective illumination for the same input.

Recognizing the demand for a moderate-priced, high-grade, durable fixture, the Central Electric Company, Chicago, Ill., has developed the cluster illustrated herewith, and which is known as the "Tungstolite." This fixture does not differ materially from the accepted stand-

TUNGSTOLITE ARC CLUSTER.

ards, is pleasing in appearance and embodies a number of structural features which are of interest. The reflector, eighteen inches in diameter, consists of an opal glass shade, formed to the proper angle to give best diffusion of light and the highest reflecting qualities. The brushed-brass canopy is four inches by five inches, and the stem, consisting of one-half-inch iron pipe, covered by one-inch brushed-brass casing, gives a pleasing and uniform effect.

Each "Tungstolite" is supplied with an iron crowfoot, fastened to a white porcelain-steel reflecting plate, on which sockets are mounted, wired complete with No. 14 double-braided, rubber-covered wire throughout; all connections are securely sealed with a high-grade insulating compound.

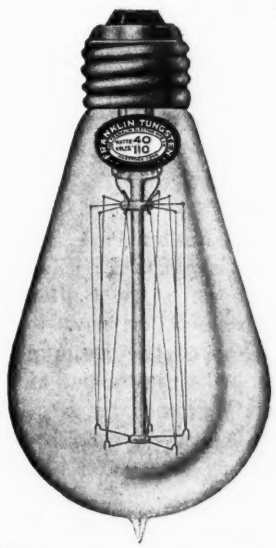
The fixture measures twenty-five inches over all when assembled with lamps, and

can be used with twenty-five, forty and sixty-watt tungsten lamps, as desired, and are made for three and four lights in a circle.

A special feature of this fixture is that each one is packed in a substantial individual wooden box ready for immediate shipment; these boxes are then mounted in shipping crates, so that when received the crates only are opened. Each fixture, being neatly boxed in the individual case, plainly marked, can be forwarded to its destination without unpacking. Combinations are furnished, enabling the use of three, four and five-light clusters.

Franklin Forty-Watt Tungsten Lamp.

A valuable addition to its regular line of tungsten lamps, in the form of a small bulb, standard Edison base, forty-watt tungsten lamp, has been made by the Franklin Electric Manufacturing Company, of Hartford, Conn. This lamp consumes from one to 1.25 watts per candle, giving about three times the light of the old carbon-filament lamp for the same consumption of current.



FRANKLIN SMALL-BULB FORTY-WATT TUNGSTEN LAMP.

The filaments are supported on light flexible springs, and the construction is such that the lamp may be burned in any position. The filaments are pulled up tightly against the supports, as may be noticed from the accompanying illustration. The same size bulb as is used with the ordinary sixteen-candle carbon-filament lamp is used with the new forty-watt lamp. The lamp possesses some advantages in being constructed with five filaments similar to other Franklin types.

Non-Elaborate Switchboard Instruments.

To meet a general demand for perfectly plain switchboard instruments of the round pattern, the Keystone Electrical Instrument Company of Philadelphia, Pa., has produced a line designated as type S and type C instruments. As shown in the accompanying illustration, these instruments are free from all unnecessary ornamentation and are provided merely with the necessary borders and lettering.

KEYSTONE DIRECT-CURRENT VOLTMETER.

These instruments comprise both direct-current and alternating-current voltmeters and ammeters of all commercial ranges. Multipliers and potential transformers are used to secure the higher voltmeter ranges and shunts and current transformers for the ammeters. The scale markings have been improved by the use of heavy lines for the prominent divisions, thus making the scale more easily legible from a distance.

The Connecticut Bell-Ringing Generator.

The Connecticut Telephone and Electric Company, Meriden, Conn., has placed on the market a bell-ringing generator designed to be used on 110-volt, sixty-cycle, alternating-current circuits.

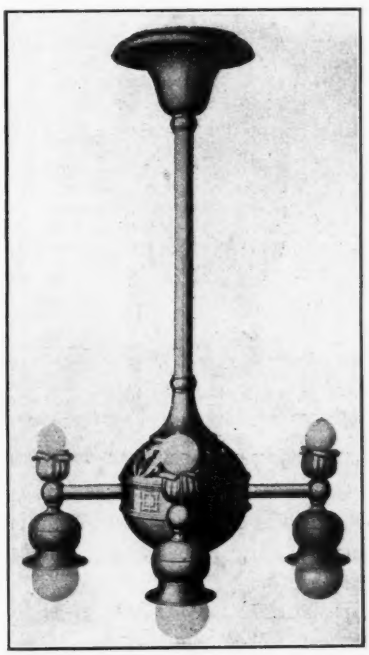
CONNECTICUT BELL-RINGING GENERATOR.

An illustration of the generator is shown herewith, the full size being six-and-three-quarter inches in diameter and three inches high. The company states that this generator will entirely eliminate battery troubles and is designed to operate the ringing of telephones, annunciators, call bells, elevator bells, gas-lighters, buzzers and electric door-openers. It may also be used for operating toys in place of dry batteries and for window decorations. Polarized bells can be rung in multiple, and the generator can be placed in a residence to operate a complete system of bells.

The standard generator is arranged to step down the primary 110-volt current to six, twelve and eighteen volts. Special transformers, however, can be furnished if desired.

Chandeliers with Nernst Candelabra Lamps.

The Nernst Lamp Company, Pittsburg, Pa., has added to the line of Westinghouse-Nernst chandeliers a new type equipped with candelabra lamps for instantaneous lighting. The candelabra lamps are mounted in a vertical position, one directly above each of the burners, and have the appearance of additional ornamentation when not burning. The candelabra lamps burn only while the heater tubes are in service and are automatically cut out with the heater tubes. When used on the 220-volt type chandelier, the candelabra lamps are connected two in series. On the 110-volt type they are connected in multiple. Chandeliers with this equipment are made in all the standard Renaissance and Art Nouveau designs.



CHANDELIER WITH NERNST CANDELABRA LAMPS.

Insulating Transformer for Telephone Lines.

An insulating transformer for use on telephone lines has recently been placed on the market by the General Electric Company. The purpose of this transformer is twofold:

First, to safeguard the users of telephones from the dangers of high voltages due either to induction or accidental contact between telephone and power lines, where these lines are on the same pole or upon a parallel adjacent line of poles.

Second, to improve the telephone service by removal of the ordinary small ground gap carbon arrester from direct connection with the line, as well as improvement through better insulation by

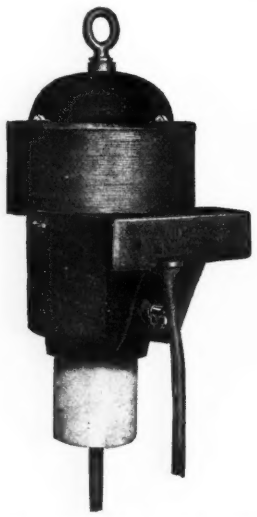


FIG. 1.—TRANSFORMER FOR TELEPHONE CIRCUITS.

removing the interior wiring, instrument, batteries, etc., from direct connection with the line.

Special attention has been given to the electrical and mechanical design of the transformer. The high-frequency talking currents are transformed with small loss, while at the same time the magnetizing current, which must be supplied by the ringing generator, is very small. Tests show that the magnetizing current taken by this transformer is about half the current passed by a standard 1,000-ohm bell. As can be seen from Fig. 1, the insulating transformer is assembled in a weatherproof iron case, and may, if desired, be installed out of doors and mounted in any convenient place.

In designing this transformer the insulation has been considered of primary importance. A high-potential test between windings of 25,000 volts for one minute is given to each transformer before shipment. The high insulating quality assured by this test makes the transformer a sturdy piece of apparatus under ordinary conditions of operation, but the best protection is afforded when it is installed with a combined switch, fuse and lightning arrester. This combination affords the greatest safety to both the telephone instruments and the user, even in the most extreme cases, when the telephone lines come in actual contact with a high-tension power circuit.

The switch, fuse and lightning-arrester combination recommended for this service is shown at the top of Fig. 2, the whole being mounted on a base of insulating material. The long-handled insulated hook at the right of the illus-

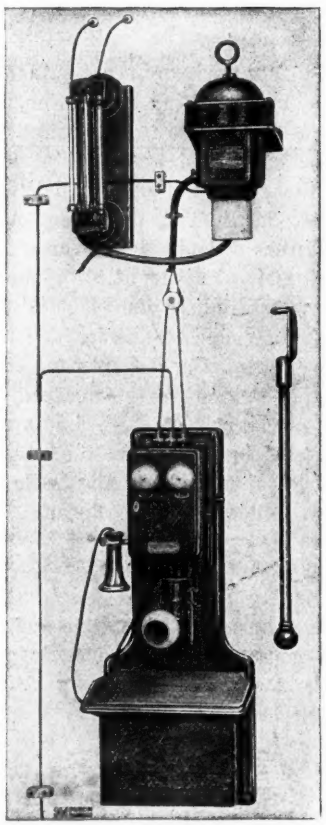


FIG. 2.—TRANSFORMER FOR TELEPHONE CIRCUITS.

tration is used to pull the switch open when it is desired to disconnect the telephone and transformer from the line. The arrester is hinged at the bottom, the insulated hook engaging with a ring at the top of the arrester. The usual form of carbon arrester with mica separation is used to protect the winding of the transformer against any abnormal difference of potential which might accidentally exist between the telephone lines. This arrester is connected across the terminals of the transformer, but is not connected with the ground.

An adjustable gap arrester is connected between the telephone lines and ground, the function of this arrester being to take care of lightning discharges, and in case of actual contact with high-tension lines to arc over and blow the fuse, thus disconnecting the transformer and telephones from the line. Should a ground occur on the adjacent high-tension line, the voltage induced on the telephone line will not materially interfere with the service, provided the line is sufficiently well insulated. The adjustable air gap is set just beyond the point where this induced voltage will arc across.

Tests on a 30,000-volt transmission line in actual operation showed that a ground on one phase of the transmission system induced a potential on the telephone line of approximately 7,000 volts, measured between telephone line and earth. Notwithstanding this high induced voltage on the telephone line, it was possible to use the telephone when the transformer was installed. The line was somewhat noisier than under normal conditions, but not so noisy as to prevent comprehensive conversation.

Great Western Power Company.

The Great Western Power Company of California has organized a subsidiary corporation known as the California Electric Generating Company, to aid in financing the electric steam generating plant now under construction at Oakland. The Great Western guarantees dividends on $2,500,000 of six per cent preferred stock, of which $600,000 has been issued. Common stock to the amount of $5,000,000 has been issued. Bonds of $5,000,000 are secured by a first mortgage on the plant and, further, by $750,000 of the Great Western Power Company's first-mortgage bonds. Part of the bonds have already been sold.

West End-Boston Elevated.

The protective committee of West End Street Railway stockholders is sending to shareholders a report of findings upon the proposed consolidation of the West End and the Boston Elevated Railway Company. It suggests that the merger be carried out by exchange of West End common and preferred into Elevated first and second preferred, share for share, of the same par value, instead of $100 par, as suggested in the present bill.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, MARCH 20.—A case of some interest to the electrical industry has been recently decided in the London police courts. The sole concessionaires of the bitumen products of the famous bitumen lake in Trinidad entered an action at law to restrain a firm in the Midlands from using the name of "Trinidad bitumen" to designate their products, which are manufactured from a substance called manjak. This recently discovered substance is found in another part of the island and is considerably richer in bitumen than the product of the lake, and the plaintiffs were up to this time entitled to an exclusive right to the cognomen in question. The action failed completely, as the presiding magistrate decided, after hearing the expert evidence, that the products of neither of the contending firms could be properly called bitumen until after treatment.

The Board of Trade has once again introduced a bill to amend the electric lighting acts. A similar bill was introduced for several years in succession, commencing with 1904, but since then little has been heard of it. In the meantime, representations have been continually made to the government to introduce such a bill and hopes are now entertained that this much-needed reform will be allowed to pass through. As showing the present anomalous, and in some instances absurd position, the following examples are chosen. Two supply authorities with contiguous areas may not supply each other in bulk, even in emergencies. In the words of the existing acts, they must not "associate." A prospective consumer in whose district there is no supply, but whose garden wall marks the boundary between his district and the next, cannot take a supply from the authority in the next district. Companies may let out motors, etc., here, but municipalities may not. A supply authority can only supply so much of a railway as is within its district, a circumstance which has prevented several railways from adopting electricity. These and a number of other legal anomalies will be abolished by the new bill if it becomes an act of Parliament.

A movement is on foot in Sheffield and the surrounding district which will have the effect of increasing the use of electricity there. A committee of local authorities, manufacturers, etc., has been formed to tackle seriously the question of smoke abatement. This action is the outcome of an exhibition in Sheffield promoted by the Local Smoke Abatement Society.

Municipal electrical trading would appear to be somewhat under a cloud just at present. Following the recent proposals by a company to acquire the Bath Corporation Electricity Works, comes a proposition from a wealthy syndicate to acquire the Newport (S. Wales) municipal undertaking. Taken all around, mainly owing to the financial requirements of the local government board, municipal electric lighting and tramway accounts are not particularly rosy for the year just ending and the bad results are emphasized by the trade depression which has existed all over the country during the past twelve months.

An X-ray convention will be held in London July 5-9 next at the Universitiy College, Gower Street. An exhibition of medical apparatus, etc., will be held in conjunction with the convention.

During the months of July, August and September, within certain hours, electric carriages will be permitted in Hyde Park, London, provided licenses are obtained. As showing the probable number of electric vehicles now running in London, it is interesting to note that 450 licenses have been applied for. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, MARCH 20.—Not long since, the Eiffel Tower wireless plant succeeded in sending signals to the station at Glace Bay, Canada, and at present messages can be sent between the two stations in a very regular way. The distance is over 3,000 miles. The Tower plant can also take the messages which are sent from Glace Bay to the Cliffden station in Ireland. These results are obtained with the present low-power plant of which Capt. Ferrié is the head. Attempts will now be made to send messages from Paris to Saigon, over a distance of 6,000 miles. The building of the new high-power wireless plant in reinforced concrete is now going on actively. It will be entirely underground, with a skylight in the central part. The work is carried on by the Military Engineering Department.

At Budapest there is a project on foot for a suburban electric line which is to run from the city to the suburb of Peczel. A new electric line will no doubt be built from Pressburg to the suburbs by the Poszony Company. It will connect with the existing system of lines in the town. At Görz there was opened an electric tramway line for traffic on February 18, and it is now in regular operation. Among the other traction lines in Austro-Hungary may be mentioned a new interurban road from Koloszvar to Klausenberg, of twelve miles length.

There is a project on foot for an electric railroad to pass through the Caucasus region. According to the present plans, it will follow the main wagon road through the Caucasus, from Tiflis to Vladicaucasus, by way of the Kvinamski Pass. This electric line is of the greatest importance from a strategic, economic and also an agricultural standpoint, seeing that it passes through fertile vine-growing and wheat-raising regions for a length of 130 miles, where there are also found numerous metalliferous deposits. Moreover, the line will reduce the time of a journey from Tiflis to Vladicaucasus to six hours. At present in order to make this trip by rail a detour must be made around the mountainous mass and pass by Baku, on the Caspian Sea, and this passage requires no less than 40 hours. The present project is brought out by a private company, of which the head is M. Koutchinsky, a leading engineer. The track will be narrow gauge, of one metre, with but few curves of as low as 330 feet radius, and the gradients will be about 1.5 per 100 in the level part of the traject and will reach 3.3 per cent in the mountainous part. Passengers and freight will be carried on the line, and provision is made at present for twenty freight trains passing each way per day, such trains to be made up of fifteen cars and having a total weight of two hundred tons or less, while the electric locomotives are to weigh fifty-five tons. There will be, besides, eight passenger trains, made up of motor cars and trailers. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, MARCH 27.—It is announced that the Canada Automatic Machine Telephone Company will be operating in the city of Brantford, Ont., by the first of May. The rates will be $25 for business and $15 for residential phones per year.

The Board of Railway Commissioners for Canada will shortly start an investigation into the telegraph and telephone rates in force in the Dominion. There has been a good deal of complaint in recent years regarding the cost of telephony and the inquiry is expected to produce some interesting developments.

The Allan Line Steamship Company will install long-distance Marconi wireless on their big ships sailing from Montreal. This means that passengers will never be out of touch of land on their voyage. The equipment will be the same as that in use on the New York liners.

The Department of Marine has made arrangements with several wireless telegraph stations under the control of the Dominion government whereby they will communicate with passing vessels, which are equipped with wireless apparatus, such information not already published respecting changes in aids to navigation on routes which vessels are taking, and also, if requested, information respecting existing weather conditions and weather prevailing during the previous twenty-four hours.

A deal is on foot to secure control of the Quebec Railway, Light, and Power Company for the Canadian Pacific Railway Company. The price which the latter company has offered the former is said to be $60 per share. About a year ago, when the Canadian Pacific was negotiating for control of the same company, $50 was the best offer for its stock at the time.

The success of electric smelting of iron, which has been the cause of investigation on several occasions by Dr. Haanel, director of mines for Canada, seems no longer in doubt. Dr. Haanel has recently received a letter from Otto Stolhane of Ludvika, Sweden, the inventor of the plan, in which it is stated: "We recently made a contract for an electric smelting plant in Norway. The first installation will be built this summer, and includes two high furnaces, 2,500 horsepower each, and two steel furnaces 600 horsepower each. All the furnaces are to be supplied with two-phase current. The plant will later be extended with four more high furnaces of the same size, and four steel furnaces of larger size. We have every reason to suppose that the plant will be erected in a perfectly modern and commercial way." This will be the first electric furnace installation in the world, on a commercial scale, for the production of pig iron.

R. S. Kelsch of Montreal has been appointed consulting engineer for the city of London, Ont. Mr. Kelsch is at present

consulting engineer with the Montreal Light, Heat, and Power Company. The new work at London will cost over $1,000,000, and includes the erection of a new light and power plant.

There is keen interest in Vancouver, B. C., over the Canadian Pacific development in electric traction and the expectation appears to be that very shortly the company will cease to run steam locomotives into that city. Sir Thomas Shaughnessy admits the possibilities of the change, but gives the impression that it is not so near as the Vancouver people think. The opinion of the president of the Canadian Pacific is that the electrification of railways will be a slow process.

In one feature of port equipment the port of Montreal will take the lead of all the ports of the world today. This is in the matter of electric transporters for unloading ships. These transporters have been specially adapted to the requirements of the port from plans prepared by Mr. F. W. Gowie, chief engineer to the Montreal Harbor Commissioners. They are constructed on the cantilever principle on a revolving base and are 112 feet in length, being capable of half a dozen distinct movements. The machine can grapple in its iron teeth a package of freight of two tons in weight lying in the hold of a steamer and hoist it up at the rate of 300 feet per minute and send it spinning along the cantilever on a steel cable at the same pace to its place in the freight shed, where it is quietly dropped. The loading process is performed with equal facility and by moving the transporter, which runs on its own wheels, the apparatus can lift freight from the shed into cars on the railway track when not required for loading and unloading steamers. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

SAO PAULO TRAMWAY—Directors of the Sao Paulo Tramway, Light, Heat and Power Company, Sao Paulo, Brazil, intend to issue $1,500,000 of common stock, bringing the amount issued up to $10,000,000. Later it is intended to divide the common stock into part preferred and part common.

ALTOONA ILLUMINATING COMPANY WILL REBUILD PLANT—The Edison Electric Illuminating Company of Altoona, Pa., has decided to rebuild its plant at a cost of some $250,000, and will contract with the General Electric and Westinghouse companies for dynamos and machinery. The American Gas and Electric Company will furnish the money as needed for the improvements.

LARGE HYDROELECTRIC POWER PLANT PROJECTED IN THE SOUTH—The application of the Piedmont Power Company to issue $3,000,000 common stock and $5,000,000 first-mortgage bonds was recently heard by the Atlanta, Ga., corporation commission. The company proposes to build dams on Tugalo River and make additional improvements of considerable magnitude. L.

WESTINGHOUSE, CHURCH, KERR AND COMPANY SECURE IMPORTANT CONTRACT—It is authoritatively reported from Bozeman, Mont., that the Gallatin Valley Electric Railway Company has let the contract to Westinghouse, Church, Kerr and Company, of New York, for the construction of an electric road to Salesville, a distance of twenty miles. The cost is estimated at about $300,000. C.

LEHIGH VALLEY TRANSIT COMPANY TO INCREASE FACILITIES—A special meeting of the stockholders of the Lehigh Valley Transit Company, Allentown, Pa., will be held May 26 to consider the authorization of an increase in the debt of the company to the amount of $1,500,000. The loan, if authorized, will be used to take up the floating debt, amounting to $500,000 or more, and for future improvements and extension of the line.

TO BUILD TWO LARGE DAMS IN MEXICO—B. Franklin Pearson, of Halifax, Nova Scotia, and a party of Halifax and Montreal capitalists, have returned home after investigating the location for the two large dams they propose to erect on the Conchas River in Chihuahua, Mexico. The dams will be near Santa Rosalia. One will be for supplying power and will cost $2,500,000 gold, while the other will cost $3,000,000 and will furnish water to irrigate 300,000 acres of land.

HYDROELECTRIC PLANT AT GRAND FALLS, N. B.—Work is now proceeding on this 100,000-horsepower undertaking, under the direction of W. Askin and C. A. Conrad, of the Frank B. Gilbreth Company. Engines, boilers, steam drills, derricks and other machinery are rapidly being erected. Air compressors and much of the electrical machinery for the temporary power plant are to be made to order. Industries and manufactures in this part of New Brunswick are expected to boom when the low-priced power from the plant under construction is available.

HYDROELECTRIC PLANT EXPECTED TO BOOST INDUSTRIES IN TENNESSEE—The announcement is made by the promoters of the lock and dam hydroelectric plant on the Tennessee River that power will be available by July 1, and that 66,000 horsepower will be used in Chattanooga. It is believed that the completed plant will cost about four million dollars and that several million dollars in industrial plants will be started as a result of the new source of power, which is claimed to be cheaper than anything offered in the past by any competitor. L.

TRANSFER OF BIG SOUTHERN POWER PLANT—The property of the Greensboro Electric Company, of Greensboro, N. C., was transferred today to the North Carolina Public Service Company, with a capital of $3,500,000 underwritten by the New York banking house of W. N. Coler and Company. The officers of the new corporation are: L. H. Hole, Sr., New York, president; B. S. Coler, New York, vice-president; L. H. Hole, Jr., New York, secretary and treasurer; Z. V. Taylor, Greensboro, general counsel. The Southern Power Company will supply the company with power.

THE PACIFIC TELEPHONE AND TELEGRAPH COMPANY HAS $16,500,000 BOND ISSUE—An issue of $16,500,000 first mortgage and collateral trust five-per-cent sinking-fund thirty-year gold bonds of the Pacific Telephone and Telegraph Company is being offered for public subscription at 95.5 and accrued interest, simultaneously in New York, Chicago, Philadelphia and Boston. The bonds may be retired at 110 on January 2, 1922, or any interest date thereafter. The new bonds are secured by a first mortgage, either direct or by deposit of securities on the entire plant and property of the company, subject only to $3,000,000 bonds of one of the constituent companies maturing in 1913.

SALE OF THE LAS VEGAS ELECTRIC RAILWAY—The plant, franchise, etc., of the Las Vegas Railway and Power Company have been sold at Las Vegas in the suit of the Trust Company of St. Louis County, trustee, vs. Las Vegas Railway and Power Company and William A. Buddecke, defendants, to satisfy the sum of $313,000 with interest, amounting in all to about $318,000. The property was bid in by Dr. J. M. Cunningham, president of the San Miguel National Bank, for $65,000. It is understood that Dr. Cunningham and others of the original Las Vegas Light and Fuel Company are associated with the United States Light and Traction Company of Denver in this big purchase.

NEW TRUNK LINE TELEPHONE COMPANY PROJECTED—A new trunk line telephone company is being organized to rival the American Telephone Company. Plans for the move were adopted at a meeting held recently in New York, at which the Keystone Telephone Company, of Philadelphia, was represented. The new corporation proposes to construct trunk lines that will include all the territory from the Atlantic to the Mississippi River and beyond. Western and European capital is engaged in the enterprise. The Keystone Company, of Philadelphia, has signed a contract to connect its system with that of the new company. C. E. Wilson, general manager of the Keystone Telephone Company, said that his company is interested in the new organization; that it is desired to extend his lines, which at present are only linked up as far west as the Cumberland Valley, to Pittsburg; and that work will be begun on this extension by the new company as soon as weather permits.

OSWEGO LIGHT COMPANY TO ISSUE $2,500,000 BONDS—The Oswego County Light and Power Company petitioned the New York up-state Public Service Commission for authority to issue $2,500,000 in bonds and to increase its capital stock of $1,000,000 to $1,100,000. The company proposes to issue the stock at this time for the development of a plant and transmission line at Salmon River Falls. The reservoir to be formed from the construction of the dam at the falls will extend easterly to Redfield, covering more than 7,000 acres. The company's incorporation authorizes it to operate in the counties of Oswego, Onondaga, Monroe, Oneida, Cayuga, Seneca, Wayne and Jefferson. At Salmon River Falls there is a direct fall of more than 1,100 feet. The river then flows with heavy grade through a deep, narrow gorge, emerging two miles below. The engineers estimate that 15,000 horsepower can be developed at an expenditure of $3,100,000, and that the plant when completed will be a $4,000,000 property, capable of earning at least 6 per cent on such valuation.

LIGHTING AND POWER

(Special Correspondence.)

STOCKTON, CAL.—The Stockton Gas and Electric Company has been granted a forty-nine-year electric-lighting franchise. A.

GLOBE, ARIZ.—Th Old Dominion copper mine is to install an electric power plant to supply the mine with electricity for lighting purposes. A.

BARABOO, WIS.—A committee has been appointed to investigate the cost of installing and maintaining a municipal electric-lighting plant. C.

LOS ANGELES, CAL.—The City Council has sold the $150,000 worth of lighting bonds recently authorized to the First National Bank of this city. A.

WADENA, MINN.—The Village Council will try the experiment of supplying a day current of electricity. Separate lines will be built for the purpose. C.

PHOENIX, ARIZ.—The Pacific Gas and Electric Company is to begin work soon on the construction of its power plant, which will cost approximately $90,000. A.

PLACERVILLE, CAL.—H. C. Marsh has filed notice appropriating 15,000 inches of water from the South Fork of the American River, to be used for generating electric power. A.

ST. PAUL, MINN.—The Northern Pacific Railway is testing a form of automatic car axle-lighting system of electric lighting for trains, invented by W. J. Bohan, chief electrician of the road. C.

SPOKANE, WASH.—The Trentwood Water and Power Company has been incorporated at this place with a capital stock of $12,000 by P. H. Renshaw, H. McNeill, F. Walton and H. Pattison. A.

ATLANTIC CITY, N. J.—The Somers Point City Council has unanimously declared in favor of a bond issue of $15,000 to build a municipal electric-light plant. A special election will shortly be held to subject the measure to popular vote.

PITTSTON, PA.—The Harwood Light and Power Company has commenced operations for the erection of a monster power house at Harwood. Both the power house and boiler houses will be entirely of steel and will be strictly fireproof.

SAN FRANCISCO, CAL.—The Equitable Light and Power Company has been incorporated here with a capital stock of $750,000 by F. G. Cartwright, A. E. Long, L. G. Meyberg, M. S. Wilson, M. D. Levenson, C. N. Beal and J. Fisher. A.

DOUGLASVILLE, GA.—The town has voted a bond issue of $10,000 for an electric-light plant in preference to granting a francnise to a private corporation. These bonds will be quickly disposed of and work on the municipal plant started. L.

WEST LIBERTY, OHIO—The council is planning to purchase the private electric-light plant in the village and conduct it under municipal ownership. A committee has been appointed to investigate municipal ownership plants in various cities. H.

ORANGE, N. J.—A special election has been ordered for May 4 for the purpose of voting on the completion of the municipal electric-light plant. This is the project that was held up by the courts recently after the contracts had been awarded.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company is reported to have started an active campaign among members of the City Council against the granting of a franchise to the Northern Heating and Electric Company, of St. Paul. C.

HENDERSONVILLE, N. C.—The Appalachian Power Company of this place has been chartered with a capital stock of $250,000 by Geo. E. Ladshaw, A. L. White of Spartanburg, S. C., and others, to develop a waterpower on Green River and its tributaries. L.

PLACERVILLE, CAL.—The Heddens Mining and Electrical Company has been incorporated here with a capital of $1,000,000 for the purpose of erecting an electrical power plant in this vicinity. The incorporators are: W. Meehan, R. D. Heddens and D. R. Caldwell. A.

BUTTE CITY, CAL.—The Sierra Electric Light and Power Company has filed articles of incorporation. The capital stock is $500,000 and the directors T. F. Wharton, B. P. Wooleyer, T. C. Warren and B. L. Wilson. The company seeks a franchise from the board of supervisors of this county.

MISSOULA, MONT.—It is stated on excellent authority that the Madison River Power Company intends to build a high-power transmission line from Billings to Livingston, with ultimate extension from Billings northward to Great Falls. The eastern terminus of the system is now at Livingston.

SEATTLE, WASH.—The Washington Water Power Company is to build another 60,000-volt high-tension power line to the new power plant under construction on the Spokane River at Little Falls. Steel towers will probably be used in preference to the cedar poles locally employed for this purpose.

BALTIMORE, MD.—It is proposed to install a new 1,000-horsepower engine and a 750-kilowatt generator at Hagerstown, with a view to doubling the capacity of the existing municipal electric-light plant. The general manager, J. C. Beard, has been instructed to ascertain the cost, which, it is estimated, will be about $20,000.

SAN FRANCISCO, CAL.—The Sacramento Valley Power Company has been incorporated here. The directors are P. C. Morf, H. C. McPike, L. Q. Haven, J. G. Dailey, J. F. McCue, F. W. Nightingill and E. A. Potter. Work is to begin this summer on the construction of reservoirs and other adjuncts of a waterpower system. A.

FRESNO, CAL.—Preliminary action has been taken by the Board of Supervisors to enable the San Joaquin Light and Power Company to make extensions of its power lines from the Fresno copper mines to the town of Sanger, a distance of nineteen miles. The company plans another line from Fresno to connect with the town of Clovis. A.

SEATTLE, WASH.—C. H. Patten, A. R. Luncheford and associates, of Spokane, will soon begin work on a $200,000 dam and power plant on Boulder Creek, near where it empties into Kettle River. They control a fall of 300 feet, and will develop, with a normal flow of water, 2,500 horsepower, which will be supplied to Orient and the towns and mines in that vicinity.

MONTAGUE, CAL.—The Siskiyou Electric Power Company will build the line from the power plant at Fall Creek to Sisson and Dunsmuir this summer. This line will connect by a cross line from Montague with the line of the Northern California Power Company, so that either line may secure a supply of power in case of accident. A.

GREEN CASTLE, IND.—The City Council is considering the granting of a franchise to a new company for the construction and equipment of a plant to light this city. The Fauvre-White long-distance transmission company is also figuring on furnishing this city with electric light and power from a plant almost completed in the coal field near Terre Haute. S.

BELLINGHAM, WASH.—Actual construction work on the big power plant of the Skagit Development Company, of Anacortes, has been started on the site near the narrows of the upper Skagit River. The undertaking is financed by Denver capitalists. It will be several months before the plant, which will be one of the biggest in the entire Northwest, is completed.

BIRMINGHAM, ALA.—A survey, which will require several weeks, is being undertaken on behalf of the Alabama Power Development Company, around and about the old dam at Jackson's Shoals, to determine the waterpower available for running a proposed power house to furnish electricity for light and power to a circuit taking in Anniston, Gadsden, Talladega and other points.

WAYCROSS, GA.—The state railroad commission at Atlanta will hear a report which will be made by Roland B. Hall, Jr., who has been in this city for some days examining into the conditions at the plant of the Waycross Electric Light and Power Company. The question of high rates and of alleged discrimination in the placing of meters, it is said, will be thoroughly looked into. L.

PROVIDENCE, R. I.—An act is being considered by the Rhode Island State Legislature that will make it obligatory for anyone engaging in electrical contracting or wiring to be registered with a state board of examiners, who shall also have authority to adopt such rules and regulations regarding wiring as it deems necessary for the public safety. The act does not apply to journeymen electricians, however.

ALBANY, N. Y.—The Up-State Public Service Commission has granted the Delaware & Otsego Light and Power Company permission to contruct and operate an extension of its electric line from East Sidney to Sidney Center, Delaware County; also authority to issue $15,000 common stock, the proceeds to be used for the discharge of obligations, the acquisition of property and extensions and improvements to its plant.

SAN FRANCISCO, CAL.—The Forest Service has allowed the Nevada-California Power Company a right to run a second transmission line through Silver Canyon, in the White Mountains, with the understanding that the concern shall make any changes in construction that may be necessary to allow the Owens River Water and Power Company to operate a line through Silver Canyon. The first-named company operates a 113-mile line to Tonopah and Goldfield.

OAKLAND, CAL.—The Great Western Power Company has awarded to the Globe Construction Company the contract for the construction of a power plant at East Oakland Heights and a substation near Sessions. The buildings are to be of reinforced concrete and to cost about $100,000. With the machinery equipment and power lines the total cost will be nearly $300,000. The company expects to deliver considerable electric power to the suburban lines of the Southern Pacific Railroad, that are now being electrified.

CHARLOTTE, N. C.—The Southern Power Company expects to have its new plant at Rocky Creek, on the Catawba River, in South Carolina, completed by April 1. This plant will be the third hydroelectric development in operation, and the company is now pushing work on the fourth and one of the largest developments under its control at Ninety-Nine Islands, on Broad River, near Gaffney, S. C. Much of the work at this plant is done by electric power transmitted from plants of the company already in operation at a distance of fifty miles or more. L.

READING, PA.—The mayor has signed an ordinance granting the Reading Electric Light and Power Company and the Metropolitan Electric Company, lessee, permission to construct, operate and maintain underground conduits from the western boundary line of the city opposite Spruce street, thence under the Schuylkill River to Spruce street, east on Spruce to Plum street, north on Plum to Chestnut street, east on Chestnut to Seventh street and north on Seventh street to connect with the plant of the Reading Electric Light and Power Company and the Metropolitan Electric Company, lessee.

ELECTRIC RAILWAYS.

(Special Correspondence.)

DULUTH, MINN.—The street-car company is considering the extension of its lines to Proctor. C.

CHICAGO, ILL.—Northwestern Elevated traffic indicates a gain of $200,000 in earnings during the current fiscal year.

GRAND RAPIDS, WIS.—The Grand Rapids Street Railway Company has been incorporated by G. F. Steele and others. Capital, $125,000. C.

OWOSSO, MICH.—It is stated on good authority that by June 1 construction would be begun on an electric car line between this city and Flint.

WHITEWOOD, S. DAK.—It is reported that Armour & Company are financing the Dakota & Western Railroad Company, which intends to build an electric line to Attainment. C.

SPARTA, WIS.—It is claimed that the $300,000 necessary to construct the electric road to Melrose has been subscribed and that the road will be in operation by November 1. C.

FRESNO, CAL.—The Fresno-Hanford Electric Railway Company has completed its lines in Fresno and Hanford and is now ready to begin work on the country sections of the road. A.

INDIANAPOLIS, IND.—Plans and specifications are being prepared by the receiver of the Indianapolis, New Castle & Toledo Company on which to ask for bids for the immediate completion of the road. S.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company is experimenting with megaphones installed in street cars to enable the motorman, instead of the conductor as heretofore, to call the names of the streets. C.

PHILADELPHIA, PA.—John L. Clawson has secured his discharge as receiver of the Atlantic City & Suburban Railway Company in the Court of Chancery of New Jersey, and the road is now in the hands of its officers and directors.

EVANSVILLE, IND.—Thirty-six miles of traction line extension will be built this summer by the four interurban roads now entering this city. The greater part of the Evansville & Mt. Carmel road will also be completed this year. S.

NEW YORK, N. Y.—In the application of the South Shore Traction Company for a franchise to run cars across the Queensboro Bridge, the company offers to carry passengers over the river for three cents, or five cents for the round trip.

ALBANY, N. Y.—The Public Service Commission, Second District, has approved of a lease by which the Buffalo & Lackawanna Traction Company leases all its corporate property, franchises and privileges to the Buffalo & Lake Erie Traction Company for a term of 999 years.

SYRACUSE, N. Y.—The hearing in the matter of the application of a franchise by the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company for a right-of-way from Seneca Falls to Auburn will be held by the Public Service Commission in the Council chamber at Auburn on April 8.

ALLENTOWN, PA.—Work will be started on the completion of the South Bethlenem and Saucon trolley line, between Colesville and Centre Valley, and several hundred foreigners will be given employment. The line between South Bethlehem and Colesville has been completed and in operation for some time.

NEW ROCHELLE, N. Y.—Permission to issue certificates for $96,000 for the purchase of twenty-two new pay-as-you-enter cars has been granted by Judge Keogh to J. A. Young, receiver of the Tarrytown, White Plains & Mamaroneck Railway. The new cars are to be used on the lines between Larchmont, White Plains and Tarrytown.

WAUSAU, WIS.—A company has been incorporated by F. J. Wood, G. Williams, B. R. Goggins, of Grand Rapids, and N. Brown, M. C. Ewing, B. F. Wilson and G. D. Jones, of Wausau, for the construction of an interurban line from Grand Rapids to this city. The stock is $125,000. The main offices will be in Grand Rapids.

FORT WAYNE, IND.—The Electric Railway General Managers' Association, which held a successful meeting at Lexington, Ky., last week, will meet in this city the last week in May. The general managers' meetings are devoted to a discussion of operating questions and the best plan of purchasing operating material and equipment. S.

ROCK ISLAND, ILL.—The Tri-City & Northwestern Railway Company has been formally organized at Port Byron by J. W. Simonson (elected president) and others. A survey is to be made soon by W. Treichler, of this city, and it is expected that the line, which is to connect Watertown and Albany, will be in operation by the end of the summer.

CHAMBERSBURG, PA.—The Chambersburg, Greencastle & Waynesboro Electric Railway Company will soon extend both ways by building a branch northward to the Red Bridge, where a fine park will be made, and another line over the mountain from Pen Mar through the summer resort region to Blue Ridge Summit, a distance of three miles. Work will be commenced as soon as possible.

WILMINGTON, N. C.—The Tidewater Power Company, controlling the electric railway interests locally and to the ocean resorts, eight miles away, will install machinery in the Wilmington steam-electric generating plant to double the capacity of this plant. New cars are being added to the system for the heavy summer travel and at the Wrightsville Beach terminus numerous improvements are under way. L.

FINDLAY, O.—It is thought that work on the new Findlay & Marion electric line will be begun by the middle of next month and H. P. Hanker and George Meeker of Findlay are now in New York making the final arrangements for the construction of the line. Twenty-three thousand dollars' worth of bonds have been subscribed and the road will pass over the original route touching Mt. Blanchard, Forest and Marseilles. H.

COLUMBUS, PA.—A new electric line is to be built between Christiana and Parkersburg by the Christiana & Coatesville Railway Company, a new company recently reorganized from the Philadelphia, Coatesville & Lancaster Passenger Railway Company. The officers of the new company are: President, W. W. Griest; vice-president, C. E. Titzel; secretary and treasurer, J. S. Graybill, Jr. The company has been capitalized at $400,000. Work will be commenced as soon as weather permits.

COLORADO SPRINGS, COLO.—The building of an electric line from Denver to Colorado Springs, Fort Collins, Greeley, Golden, Morrison and almost every town in the eastern half of the state is provided for in articles of incorporation filed yesterday with the secretary of state for the Denver & Fort Collins Interurban Railway Company. The capital stock is $1,000,000. The incorporators, all of Denver, are: John Olson, Leslie DeRemer, Fred O. Olsen, Ralph Dougherty, R. E. Inskeep, Demerit E. Brown and Abner Graves.

SAN FRANCISCO, CAL.—The California Company has filed a condemnation suit in Solano County against the Vallejo Northern Railway Company. The plaintiff seeks to acquire the right-of-way procured by the Vallejo Northern Company through Solano County on the grounds that the latter company has failed to begin construction of its proposed road within the stipulated two years after securing the franchise. The California Company, formed but a few months, proposes to build an electric road from Tiberon to Sacramento. A.

CHICAGO—After having been twice defeated, the franchise for the Kensington & Eastern Railroad was passed by the Chicago City Council on March 29. The franchise enables this road, which is a subsidiary of the Illinois Central Railroad, to build a connecting line from Kensington on the latter's main line to the city limits, from which point the road has been built to Hammond and Gary, Ind. This connection affords a means for the Illinois Central to reach Gary and also for the Chicago, Lake Shore & South Bend Electric Railway to reach the centre of Chicago over the Illinois Central Railroad.

PLATTSMOUTH, NEB.—Articles of incorporation of the Plattsmouth & Southwestern Interurban Railway have been filed with the county clerk. The amount of the capital stock authorized is $100,000, in shares of $100 each. The incorporators are Judge H. D. Travis, J. P. Falter, R. B. Windham, W. W. Coates and C. C. Parmele. The object of the corporation is to construct an interurban railway from Plattsmouth in a southwesterly direction through the towns of Mynard, Manley and Murdock, continuing on to the west end of Cass County, with diverging lines to Union, Weeping Water, Louisville, Elmwood, Greenwood and Eagle. It is understood that the work of the surveyors will be commenced shortly.

AUSTIN, TEX.—The Attorney-General to-day approved and the Secretary of State filed for record the articles of incorporation of the Oklahoma, Vernon & Pacific Railroad Company; principal office, Vernon; capital stock, $125,000; purpose, to construct a line of railway from the town of Vernon, passing in a southwesterly direction through the counties of Wilbarger, Foard, Cottle, King and Dickens into Crosby County, to the town of Estacado in Crosby County, a distance of 125 miles; incorporators, L. G. Hawkins, W. O. Anderson, B. J. Parker, L. J. Massey, Robert Houssels, T. J. Youngblood, J. D. Hagler, T. H. Shives, J. Ray, J. E. Dodson, G. J. Gibbs, A. C. Hahn, C. P. Smith, J. F. Minarik and B. Houssels, all of Vernon.

TOLEDO, O.—John G. Webb and his associates, mainly Cincinnati and Louisville capitalists, are back of a deal to build the new interurban road to close the gap between Toledo and Columbus. The new line will also complete a continuous system of interurbans between Cleveland, Cincinnati and Louisville. Headquarters have been established at Marion and the work of locating the right-of-way will be begun immediately. H. L. Weber, chief engineer, will have this work in charge. The new line will extend from Marion to Upper Sandusky, thence to Fostoria, paralleling the Hocking Valley or to Findlay, via Carey, paralleling the Toledo & Ohio Central in part. It has been announced that the financing of the road is completed. H.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

WACO, TEXAS—The Texas Telephone Company has sold out to E. Rotan and J. B. Earle.

CORDELL, OKLA.—The Cordell Light and Power Company is to install a modern light plant.

BRADLEY, S. D.—F. R. Hoover and others are organizing a telephone company in this city.

CHISHOLM, MINN.—The Mesaba Telephone Company will install a new telephone exchange here.

RYAN, OKLA.—This city will vote on a proposed issue of $69,000 in bonds for an electric-light plant.

MINCO, OKLA.—The Consolidated Telephone Company has been incorporated with a capital of $5,000.

KEARNEY, NEB.—The Union Valley Telephone Company has been incorporated with a capital stock of $5,000.

MILWAUKEE, WIS.—The Wausau Telephone Company has increased its capital stock from $20,000 to $80,000.

FLETCHER, OKLA.—The Fletcher Telephone Company has been incorporated with a capital stock of $10,000.

McCLUSKY, N. D.—The Lamont Telephone Company has been incorporated with a capital stock of $4,000.

WEBSTER CITY, IOWA—The Air Line Telephone Company has been organized, with Irving Lasher as secretary.

KANSAS, OKLA.—The Delaware Central Telephone Company has been incorporated by D. A. Smith and others.

BEACH, N. D.—The Golden Valley Telephone Company will install a modern telephone system and some rural lines.

CLEVELAND, OHIO—The Wharton Telephone Company, of Wharton, Ohio, has incorporated, with a capital of $10,000.

RAYMOND, WASH.—The Willipa Harbor Telephone Company has been incorporated with a capital stock of $30,000.

WAYNOKA, OKLA.—The Waynoka Electric Light and Power Company has been incorporated with a capital stock of $2,500.

MOSCOW, N. D.—The Wales-Moscow Coöperative Telephone Company has been incorporated with a capital stock of $3,000.

JEFFERSON, TEX.—The Jefferson Ice, Light and Power Company has been incorporated with a capital stock of $50,000.

LONG PRAIRIE, MINN.—G. Lano and others will arrange for the construction of a rural telephone line out of this city.

GLENVILLE, NEB.—The Glenville and Inland Telephone Company has been incorporated with a capital stock of $10,000.

CORTLAND, NEB.—M. M. Stanley and others have incorporated the Highland Telephone Company with a capital of $21,000.

BRUSHVALE, MINN.—The Brushvale Farmers' Telephone Company has been incorporated with a capital stock of $10,000.

CEDAR RAPIDS, NEB.—The Timber Creek Independent Telephone Company has incorporated with a capital stock of $4,000.

COLUMBUS, OHIO—The Atwater Telephone Company, Atwater, Portage County, has been incorporated by W. E. Craig and others, with a capital of $10,011.

SELMA, ALA.—There will be constructed in the near future a new telephone line from this city to York, with stations at Coatopa, Lileta, Bellamy and other points.

SAN FRANCISCO, CAL.—The entire issue of $16,500,000 Pacific Telephone and Telegraph Company first mortgage collateral trust five-per cent bonds has been sold.

STEVENS POINT, WIS.—Plover residents and farmers living between that village and Bancroft have constructed what will be known as the Coddington telephone line. It is connected with the Wisconsin company's system.

ST. PAUL, MINN.—Representatives of forty independent telephone companies of Minnesota met in St. Paul and organized as the Minnesota Mutual Telephone Association. Officers were elected as follows: President, L. F. Clark, Bellingham; first vice-president, George Ocobock, Norwood; second vice-president, D. M. Neill, Red Wing; secretary, W. S. Clay, Hutchinson; treasurer, C. H. Edwards, Mankato; monitor, A. V. Rieke, Fairfax. C.

CENTRALIA, WASH.—W. W. Cannon, C. S. Gilchrist and F. B. Hubbard, of Centralia, in connection with J. L. Meyers, of South Bend, and H. W. McPhail, of Raymond, have incorporated a company and have secured franchises in South Bend and Raymond for the construction and operation of telephone lines. The firm name is the Willapa Harbor Telephone Company. The capital is $30,000. Under this arrangement the present Raymond and South Bend systems will be connected and both connected with the Sunset long-distance system.

GRAND RAPIDS, MICH.—A stock company has been organized at Sunfield, Mich., for the purpose of operating a local telephone exchange. The company is the outgrowth of dissatisfaction with the rental rates of the Bell company, which owns the exchange here. Those on the farm were the principal agitators of the stock company. The new company probably will buy the local Bell exchange, otherwise a new exchange will be built.

TOLEDO, OHIO—A meeting of farmers was held at Fostoria, Ohio, Saturday, March 20, to consider the matter of organizing a mutual telephone company. A temporary organization was effected and the officers authorized to appoint a committee to canvass the territory and secure subscriptions. S. E. Stricklin, of Toledo, representing the Bell Telephone Company, was present and spoke at length, pointing out the advantages of the regular service and expressing his views as to why the mutual company would prove less satisfactory than the regular service. The officers elected at the meeting Saturday are: President, Calvin Myers; vice-president, Oliver Stewart; secretary, S. C. Ellarton; treasurer, Ora Whitmore. H.

NEW PROPOSALS.

POST OFFICE, KEWANEE, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 p. m., April 28, for the construction, complete, of the United States post office at Kewanee, Ill., in accordance with the drawings and specifications, copies of which may be had at the office of the postmaster at Kewanee, Ill., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, LAKE CHARLES, LA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 p. m., May 3, for the construction (complete) of the United States Post Office and Court House at Lake Charles, La., in accordance with drawings and specifications, copies of which may be had from the postmaster at Lake Charles, La., or from the Supervising Architect.

BUILDING, ETC., PORTLAND, ME.—The office of the Constructing Quartermaster, 478½ Congress Street, Portland, Me., will receive sealed proposals, in triplicate, until 10 a. m., April 9, for construction, electric wiring, heating, etc., of addition to be placed on hospital building at Fort Williams, Me. A guarantee of 10 per cent required. Plans, specifications and proposal blanks can be had upon application to Capt. F. J. Morrow, at this office.

POST OFFICE, BARRE, VT.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 p. m., April 26, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States post office at Barre, Vt., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Barre, Vt., or at the Supervising Architect's office.

POST OFFICE, DOTHAN, ALA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., April 5, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Dothan, Ala., in accordance with drawings and specifications, copies of which may be obtained from the custodian of the site at Dothan, Ala., or at the Supervising Architect's office.

POST OFFICE, MARION, OHIO—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., April 7, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Marion, Ohio, in accordance with drawings and specifications, copies of which may be obtained from the custodian of the site at Marion, Ohio, or at the Supervising Architect's office.

POST OFFICE, MICHIGAN CITY, IND.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 p. m., May 1, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States post office at Michigan City, Ind., in accordance with the drawings and specifications, copies of which may be had from the custodian of the site at Michigan City, Ind., or at the Supervising Architect's office.

POST OFFICE, COURT HOUSE AND CUSTOM HOUSE, NEWBERN, N. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 p. m., April 23, for the installation of a conduit and wiring system, and extension of the present gas-piping system, in the United States post office, court house and custom house, at Newbern, N. C., in accordance with the drawings and specifications, copies of which may be had from the custodian at Newbern, N. C., or at the Supervising Architect's office.

UNITED STATES GOVERNMENT BUILDINGS, ALASKA-YUKON-PACIFIC EXPOSITION, SEATTLE, WASH.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., April 19, for the installation of an electric wiring system for the United States Government Buildings at the Alaska-Yukon-Pacific Exposition, at Seattle, Wash., in accordance with drawings and specifications, copies of which may be had at the Supervising Architect's office, or at the office of the Superintendent of Construction, United States Government Buildings, Seattle, Wash.

ELECTRICAL SECURITIES.

Speculative dullness and strictly professional trading continue the main characteristics of the stock markets. A firm tone ruled last week, however, and for the period fairly general advances were scored.

Public indifference to stock market happenings continues and leading brokers look for no early change. At the same time there is no evidence of liquidation. The fact that the market has held firm in face of bad news and has even advanced at times is regarded in many quarters as a significent bullish indication.

Dividends have been declared upon the following electrical securities: Mexican Telephone and Telegraph Company; the regular semiannual dividend of two-and-one-half per cent on the preferred stock, payable May 1 to stock of record April 16. Scranton Electric Company; regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable April 1 to stock of record March 23. Chicago Telephone Company; regular quarterly dividend of two per cent, payable March 31 to stock of record March 27. New England Telephone and Telegraph Company; regular quarterly dividend of one-and-one-half per cent, payable April 15 to stock of record March 31. Bell Telephone Company of Missouri; quarterly dividend of two per cent, payable April 1. New York & New Jersey Telephone Company; regular quarterly dividend of one-and-three-quarters per cent, payable April 15 to stock of record April 5. Electric Storage Battery Company; regular quarterly dividends of three-quarters of one per cent on the preferred stock and three-quarters of one per cent on the common stock, payable April 1. Bell Telephone Company of Pennsylvania; the regular quarterly dividend of one-and-one-half per cent, payable April 15 to stock of record April 5. Manchester Traction, Light and Power Company; regular quarterly dividend of two per cent, payable April 15 to stock of record April 1. Philadelphia Company; regular quarterly dividend of one-and-one-half per cent on the common stock, payable May 1 to stock of record April 1. Central District and Printing Telegraph Company; regular quarterly dividend of two per cent, payable April 30. Central & South American Telegraph Company; regular quarterly dividend of one-and-one-half per cent, payable April 7.

ELECTRICAL SECURITIES FOR THE WEEK WEEK ENDED MARCH 27.

New York:	*Closing.*
Allis-Chalmers common	14¼
Allis-Chalmers preferred	44¾
American Tel. and Tel. Company	130¾
Brooklyn Rapid Transit	72⅜
General Electric	157
Interborough-Metropolitan common	13½
Interborough-Metropolitan preferred	40¼
Kings County Electric	125
Mackay Companies (Postal Telegraph and Cable) common	72¾
Mackay Companies (Postal Telegraph and Cable) preferred	70⅝
Manhattan Elevated	142
Metropolitan Street Railway	20
New York and New Jersey Telephone	110
Western Union	66½
Westinghouse Manufacturing Company	82

The General Electric Company is operating its plants on a basis of between fifty-five per cent and sixty per cent of normal. The business of the company in the last fiscal year amounted to approximately $44,000,000, and it is hoped in the current fiscal year that the business will reach $50,000,000. The annual meeting of the company will be held May 11 in Schenectady. Books close April 10 and reopen May 12.

Boston:	*Closing.*
Edison Electric Illuminating	253
Massachusetts Electric	72¾
New England Telephone	132½
Western Telephone and Telegraph pref.	....

The total amount of American Telephone convertible 4's deposited for conversion has now crossed the $40,000,000 mark.

Directors of the New England Telephone and Telegraph Company have voted that $3,562,400 of additional capital stock be offered at par to stockholders of record at the close of business April 23. Subscriptions must be made not later than May 31. Payment for half the number of shares subscribed for is to be made July 16, 1909, and for the remaining half, January 17, 1910, the certificates to be issued as of respective dates of payment.

Philadelphia:	*Closing.*
Electric Company of America	12
Electric Storage Battery common	45
Electric Storage Battery preferred	45
Philadelphia Electric	11⅞
Philadelphia Rapid Transit	28¾
United Gas Improvement	90¼

The gross earnings of the Philadelphia Rapid Transit Company have been very favorable for the last four months. February, though shorter by one day than that month last year, was an increase of $59,000, while January and December exceeded those months a year ago by $50,000 and $68,000, respectively. Notwithstanding the gain in December the company was considerably behind in its receipts on December 31.

Chicago:	*Closing.*
Chicago Telephone	....
Commonwealth Edison	109½
Metropolitan Elevated preferred	50
National Carbon common	85
National Carbon preferred	118

NEW MANUFACTURING COMPANIES.

RICHMOND, VA.—The Ball Electric Company has been granted a charter by the state, the capital stock being placed at $15,000. R. H. Ball is president; A. L. Lucas, vice-president; B. A. Ruffin, secretary and treasurer. The company will deal in electrical supplies. L.

TOLEDO, OHIO—The Fowler Electrical Supply Company, of Toledo, has been incorporated with a capital stock of $30,000. The company will take over the business formerly conducted by Harry Fowler on Cherry street. The incorporators are: Harry R. Fowler, J. W. Schauffelberger, Henry P. Fowler, Fred B. Willard and Carlton F. Jones. H.

MOBILE, ALA.—A $20,000 company has been recently organized here under the name of the Modern Electric Appliance Company, to buy, sell, own, exchange, or otherwise dispose of United States patents, as well as foreign patents and patent rights. J. J. Blacksher is president, E. E. Wagar, vice-president, and B. B. Chamberlain, secretary and treasurer.

ENGINEERING SOCIETIES.

MODERN SCIENCE CLUB OF BROOKLYN, N. Y.—The Modern Science Club, of Brooklyn, N. Y., announces the following lectures, at its clubhouse, 125 South Elliott place: April 6—"Electric Motor Design," by Charles A. Lundell, of the Thompson-Bonney Company. April 10—Informal discussion on "Parsons Steam Turbine," introduced by Frank Martin. April 13—Annual election. April 20—"The Gas Engine in Blast Furnace Practice," by George A. Orrock, M. E., of the New York Edison Company. April 24—"Design of Air Compressors," by Z. Oberschall. April 27—"Absorption Refrigerating Machines," by Henry Torrance, Jr., of the Carbondale Machine Company.

DATES AHEAD.

Louisville Electrical Show. The Armory, Louisville, Ky., April 12-24.

Missouri Electric Light, Gas and Railway Association. Annual convention, Springfield, Mo., April 15-17.

Iowa Electrical Association. Annual convention, Cedar Rapids, Iowa, April 21-22.

Iowa Street and Interurban Railway Association, Cedar Rapids, Iowa, April 22-24.

American Electrochemical Society. Next meeting, Niagara Falls, Ontario, May 6-8.

Omaha Electrical Show. Omaha Auditorium, Omaha, Neb., May 6-15.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., May.

Arkansas Association of Public Utility Operators. Annual meeting, Hot Springs, Ark., May 12, 13, 14.

American Association of Electric Motor Manufacturers. Annual convention, Hot Springs, Va., May 17-20.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual convention, Canton, Ohio, May 21-22.

West Virginia Independent Telephone Association. Annual convention, Parkersburg, W. Va., May 27-28.

National Electric Light Association. Annual convention, Atlantic City, N. J., June 1-4.

Association of Edison Purchasing Agents. Annual convention, Atlantic City, N. J., June 1-4.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June.

Canadian Electrical Association. Annual convention, Quebec, Canada, June 16-18.

Association of Railway Telegraph Superintendents, Detroit, Mich., June 23.

American Institute of Electrical Engineers. Annual convention, Thousand Islands, N. Y., June 28.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

PUBLICATIONS.

ELECTROLYTIC CORROSION OF THE BOTTOM OF OIL TANKS AND OF OTHER STRUCTURES—Adolphus A. Knudson, the well-known consulting engineer, New York city, has reprinted in pamphlet form his address on the above subject, which was read at the fourteenth general meeting of the American Electrochemical Society, New York, October 30, 1908.

NEW YORK STATE PUBLIC SERVICE COMMISSION, SECOND DISTRICT—The Public Service Commission for the Second District, State of New York, has issued in pamphlet form its decision in the matter of the application of the Erie Railroad Company for authority to issue five-per-cent collateral gold bonds, to the amount of $30,000,000; submitted January 5, 1909; decided March 2, 1909.

PANAMA CANAL.—"The Text of a Lecture Before the Commercial Club of Boston," by Philippe Bunau-Varilla, on the Panama Canal, has been reprinted from the Congressional Record. The text of the lecture is followed by a supplement bearing on some important points which were omitted from the lecture through lack of time. A third chapter, formed of extracts from testimonies given before the Congressional Committee on Interstate and Foreign Commerce, at Ancon, C. Z., has been appended.

THE MECHANICS' INSTITUTE—The General Society of Mechanics and Tradesmen of the City of New York has issued its 123d report. The Mechanics' Institute is maintained by the above society and gives free instruction to upward of 2,000 young men in its technical and industrial classes, including instruction in architectural, mechanical, sheet metal and carriage drafting, free-hand design and life drawing, clay modeling, mathematics, physics and electrical work, plan reading and estimating. The library of the society carries a valuable reference department, which is free to the public.

PRINCIPAL FACTS OF THE EARTH'S MAGNETISM—The United States Coast and Geodetic Survey has had reprinted the first part of the United States Magnetic Declination Tables and Isogonic Charts for 1902, as a 100-page book, entitled "Principal Facts of the Earth's Magnetism." There has been continued demand for general information concerning the earth's magnetic phenomena, and this is the information that this book is intended to supply. It contains a history of the compass and of magnetic discoveries, a discussion of variations of the earth's magnetism, the making of magnetic surveys and charts, and the determination of the true meridian and the magnetic declination.

THE ILLUMINATOR—The Illuminator, edited by Milton Hartman, is being published regularly from Cleveland by the Tungstolier Company of Cleveland, Ohio. In the first two issues which have come to our notice, published respectively for January and February, there is considerable interesting reading matter, although it is likely that the illuminating engineer will not take kindly to some of the things which Mr. Hartman has been bold enough to say. The Tungstolier fixtures are worthy of good publicity and Mr. Hartman is giving them this. If the illuminating engineers do not like what he says it is all right, because it won't hurt them and will help the Tungstoliers very much.

MAGNETIC WORK OF THE CARNEGIE INSTITUTION—That portion of the annual report of the director of the Carnegie Institution of Washington for the year 1908 relating to the work of the department of terrestrial magnetism has been printed separately in pamphlet form. The very successful magnetic survey of the Pacific Ocean made in the yacht Galilee in her cruise of over 60,000 nautical miles during the three years 1905-1908 is described at some length with the aid of a chart. The new magnetic survey yacht Carnegie now being built almost entirely of non-magnetic material is shown in an excellent engraving and briefly described. The balance of the report is devoted mainly to the magnetic surveys of land areas that have been carried out under the auspices of the Institution. As the result of these and similar labors it will be possible shortly to draw a new set of magnetic charts for nearly one-third of the globe.

LIGHTING RAILWAY CARS—A comparison of the different ways of lighting railway trains by electricity, showing the advantages and defects of each method, has just been published in a bulletin entitled "Investigation of Methods of Railway Train Lighting," in the engineering series of the University of Wisconsin. The author, Edward Wray, received his degree of electrical engineer at the university in 1906. After tracing the advance of lighting methods in railway cars from the single candle used in English coaches in 1825, through early experiments with oil lamps and adaptations of all the various methods used in lighting streets and houses, Mr. Wray describes the storage battery equipments, steam-driven generators in baggage cars, and axle generating equipment in individual cars. "It is impossible to make a sweeping claim of superiority for any one type of equipment," says the author. "Each is more or less applicable to certain kinds of service. The success of any of the types of lighting equipment lies largely in the hands of the railway operating department. The simplest of all the electrical equipments is undoubtedly the straight storage equipment." Storage batteries, however, must be charged each day, the bulletin points out, requiring expensive charging stations at terminals, and making this mode of lighting impractical for long overland runs. For short runs with heavy traffic and a large number of cars the storage battery is most economically operated.

THE UNIVERSAL ELECTRICAL DIRECTORY—J. A. Berly's Universal Directory for 1909 (published in January of each year) has been thoroughly revised locally, as well as by circulars. It contains the names and addresses of the members of the electrical trades and allied industries all over the world. The 1909 edition consists of four sections—British, with 13,334 names; colonial and general, 5,318 names; continental, with 7,952 names; United States, with 5,290 names, a total of 31,894 names, and this after a careful elimination of unimportant entries. Each section is again subdivided into an alphabetical and classified section, and in the case of the British a geographical section has been added, which is of unquestioned use to travelers. A thumb index simplifies the turning up of any part desired. The alphabetical sections include telegraphic addresses and telephone numbers and codes and many financial particulars regarding British limited liability companies. Lists of all electricity undertakings in the United Kingdom, British colonies and some other countries are given, showing the nature of the supply, system of distribution, capacity of plant, voltage, and chief engineer's name, and in the case of alternating current the phase and periodicity also appear. The prices of the Directory post free in the United Kingdom are 14 shillings, colonies 15 shillings, United States of America $4.50, other countries 16 shillings. The "A" edition, started a few years ago for the convenience of home and colonial firms, contains the British and colonial and general sections only, prices four shillings less in each case.

PERSONAL MENTION.

MR. W. F. McROBERTS has been elected secretary and treasurer of the Sharon (Iowa) Farmers' Mutual Telephone Company. C.

MR. G. W. ARMSTRONG, manager of the Chicago branch of the Excello Arc Lamp Company, was an attendant at the jobbers' meeting at Niagara Falls this week.

MR. FRANK LIPPERT, of Davenport, Iowa, has been appointed superintendent of the Interstate Telephone Company, and will make his headquarters at Cascade.

MR. R. F. PIERCE has resigned the management of the Minerallac Company and will go to New York as general sales manager and publicity agent of the Excello Arc Lamp Company.

MR. GEORGE B. CORTELYOU was elected president of the Consolidated Gas Company, of New York, on March 25, and has already assumed his duties. Mr. Cortelyou was also elected a director of the company in place of Dr. Arthur H. Elliott, resigned.

MR. A. M. LITTLE, who formerly traveled for Pass & Seymour in the Middle West, has resigned to accept a position as general manager of the Mohawk Electric Supply Company, of Syracuse, N. Y. The new position is one of considerable advancement, and Mr. Little leaves his old company with the best wishes for his success.

MR. H. CAIRD, formerly manager of the street-railway department for the Central Electric Company, has assumed his duties as sales engineer in the Chicago branch of the Excello Arc Lamp Company. Mr. Caird has had a wide experience in the design and installation of lighting equipment, and his services will be of value to the Excello company's customers.

MR. H. E. BUCK of Delaware, O., general manager of the Columbus, Magnetic Springs & Northern Electric line, has tendered his resignation, to take effect on April 1. His successor will be Charles Fifer of Pittsburg, an experienced electric railway man. Mr. Buck will still be connected with the line in the capacity of secretary, and will be in full charge of the financial end of the business. H.

MR. F. THOS. TURNER, formerly with the Grand Rapids-Muskegon Power Company, at Grand Rapids, Mich., has been appointed to represent throughout Indiana and Kentucky the American Electric Fuse Company of Muskegon, Mich., manufacturers of telephone specialties, motor controllers, black enameled wire and gas-engine ignition equipments. Mr. Turner's headquarters will be at the Linden Hotel, Indianapolis, Ind.

MR. L. ROBINSON has been appointed manager of the insulating department of the Standard Varnish Works, with headquarters in New York. Mr. Robinson has been identified with the Standard Varnish Works. For fifteen years previous to Mr. Robinson's connection with the Standard Varnish Works he held numerous responsible positions in the operating end of electric railways in the United States, Canada and Europe.

MR. W. E. PEMBERTON has been appointed manager of the Minerallac Company, Chicago. Mr. Pemberton was for a number of years with the Commonwealth Edison Company in the capacity of consulting engineer. He has been in the electrical field eleven years, and has been connected with the Edison interests most of that time. The company's specialties enter widely into central-station work and Mr. Pemberton's experience in this direction makes him a strong factor in this field.

INDUSTRIAL ITEMS.

THE KEYSTONE LUBRICATING COMPANY, Philadelphia, Pa., has issued a pamphlet advocating the use of a pure mineral grease for general lubrication. A copy may be obtained upon application to the main office of the company, or to any of its agencies.

THE NELSON VALVE COMPANY, Philadelphia, Pa., has issued its handsome 1909 catalogue and price list of 220 pages, on valves, accessories and fittings. Besides numerous fine halftone illustrations, it contains some interesting information on valves generally. This issue supersedes all previous ones.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing an attractive bulletin entitled "Present Conditions (an Echo of the Panic) from the Central Station Point of View," and emphasizing the utility of the single-phase motor as the "hard-times" friend of the Central Station.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has issued a circular on fan motors, in which a new ball-bearing oscillating-rotating fan, with several improvements, is described. A new circular on pull sockets, and a trade price list of Opalux shades and reflectors, are also ready for distribution. Copies may be had on request.

THE SACHS COMPANY, 618 Capitol Avenue, Hartford, Conn., announces that in the suit brought in the United States Circuit Court, District of Connecticut, by the Johns-Pratt Company, based on letters patent to Joseph Sachs, No. 660,341, for an improvement in safety fuses, alleging infringement, that District Judge Platt on March 12 dismissed the bill of complaint.

THE PHOENIX GLASS COMPANY, 15 Murray street, New York city, describes in catalogue B a new series of reflectors for tungsten lamps. The Phœnix Glass Company, which is famous for its inner globes and other electrical glassware, is embodying in the new line a wide range of beautiful creations, in which the artistic and the useful are sensibly blended.

THE WYCKOFF PIPE AND CREOSOTING COMPANY, 50 Church Street, New York, has published some very interesting data on creosoting materials. This company is the manufacturer of creosoted conduit for underground wires, creosoted poles, cross-arms, anchor plugs and signal posts, crossties, fence posts, piles, wharf and bridge timbers, paving blocks, plank, and all kinds of creosoted lumber.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued a new illustrated price list on regular panels, Types E, ES, P, PS, which can be shipped at once from stock and on which special discounts will be quoted on application. The "Trumbull Cheer" for March is full of interestinig matter on switches and panel boards, in addition to some other pleasant reading.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, is distributing an interesting mailing card depicting a military balloon in action. The company wants to know whether, "in the battle for business, may we not be your allies?" There is included in this literature an argument and some logic concerning the reasonableness of convincing customers that what they want is more light at the same cost rather than the same light for less cost. There is also a good illustration of the Buckeye 115-volt, sixty-watt tungsten lamp.

THE UNION SWITCH AND SIGNAL COMPANY, Pittsburg, Pa., is distributing several pieces of literature devoted to the following subjects: Bulletin No. 38, the Union Electro Manual Block System; Bulletin No. 39, the Union Electric Crossing Gate. There is also a supplement to the 1902 catalogue of Sections 16 and 17, showing Plates 1631, 1632 and 1633—Switch Indicator and Relay Box Posts, Semaphore Type of Indicator.

THE FANCLEVE SPECIALTY COMPANY, Jamaica Plain Station, Boston, Mass., has issued its April, 1909, catalogue of electrical fittings, as switch boxes, outlet boxes and plates, junction boxes, switch mounts, molding boxes, reduction boxes, etc., for various purposes. In presenting this catalogue to the trade the company announces that it is prepared to alter any of the fittings illustrated or listed to suit special requirements.

THE GUARANTEE ELECTRIC COMPANY, Chicago, announces that it has purchased the entire stock of alternating-current second-hand motors, also certain types of new motors, from the Wagner Electric Manufacturing Company. The Guarantee company can make immediate shipments from Chicago or St. Louis from the above stock and will be glad to send full information concerning the above to those in the market for alternating-current motors.

THE FT. WAYNE ELECTRIC WORKS, Ft. Wayne, Ind., in bulletin No. 1114, illustrates and describes the Ft. Wayne electric fan motors. This catalogue is arranged for easy and convenient reference without being overburdened with descriptive matter. The illustrations are well arranged, and the listings and prices so indicated as to facilitate reference. The company is also distributing bulletin No. 1112, devoted to type ML three-bearing, belted direct-current generators with balance wheels.

F. B. BADT AND COMPANY, 1504 Monadnock Block, Chicago, the well-known mechanical and electrical engineers, have been appointed western sales agents for the Standard Electric Accumulator Company, of 91 Mercer street, New York city. The makers claim that in this battery the plates cannot buckle, disintegration is impossible, there is no expense for labor and material when installed, cleaning is eliminated, and that the annual saving on the investment is worth consideration.

THE NERNST LAMP COMPANY reports that the lighting of the handsome new storerooms to which the John A. Renshaw Grocery Company recently removed in Pittsburg is accomplished by chandeliers equipped with 132-watt Westinghouse-Nernst lamps and inverted gas burners. The chandeliers are of the Art Nouveau design and are finished to correspond with the hardware decorations of the building. The new White House of San Francisco was opened for business Saturday, March 13. It is lighted by multiple-glower Westinghouse-Nernst lamps in ornamental fixtures. The total installation consists of one thousand glower units. This is one of the finest stores in the rebuilt downtown district. The new First National Bank and the remodeled Dollar Savings Bank, of Youngstown, Ohio, will both be lighted by multiple-glower Westinghouse-Nernst lamps in ornamental housings.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) March 23, 1909.

915,748. MEANS FOR ELECTRICALLY OPERATING TYPE-SETTING MACHINES. Heinrich Drewell, Charlottenburg, Germany. Filed June 11, 1907. The character-delivery electromagnets are directly controlled by corresponding automatic switches whose circuit connections are controlled by a register band and two electromagnets.

915,768. ELECTRICAL SYSTEM OF DISTRIBUTION. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. Filed June 9, 1906. Between an alternating and a direct-current circuit is a motor-generator set with a storage battery and booster in parallel with the direct-current side, means for regulating the booster field and that of the direct end of the motor generator.

915,774. COMPOSITION OF MATTER FOR AND PROCESS OF MAKING INSULATING MATERIAL. Carl A. Keller and Bertrand G. Jamieson, Chicago, Ill. Filed December 26, 1907. Consists of sand, hydraulic cement and a saponifiable waterproofing compound impregnated with an asphaltum insulating fluid.

915,786. ELECTRICAL PLATING RACK. Douglas B. Moyer, Detroit, Mich. Filed March 16, 1908. A cathode hanger comprises a conducting rod, a wood sheathing for protecting it and a detachable branch rod projecting laterally through the sheathing.

915,797. GUARD FOR ELECTRIC RAILWAY RAIL-BONDS. Jacob J. Sapper and Joseph G. Brueggemann, St. Louis, Mo. Filed August 26, 1907. The plate has a flange on the top and sides of that side turned to the web of the rail, thus forming a chamber for the bond.

915,824. ELECTRIC HEAD CAP. George M. Branaman, Kansas City, Mo. Filed April 25, 1908. Straps pass around the head and hold an ear bob with battery terminals against the ear.

915,846. ELECTRODEPOSITION OF METAL ON HOLLOW ARTICLES. Ernest Friedheim, Paris, France. Filed March 26, 1907. The apparatus is composed of conducting rods mechanically and electrically connected to a common supporting anode and insulating sleeves adapted to prevent short-circuiting, in combination with hollow cathodes encircling the anodes.

915,891. SPARK TIMER FOR INTERNAL COMBUSTION ENGINES. Henry Schaake and John T. Cowie, New Westminster, British Columbia, Canada. Filed February 7, 1908. Has two brushes bearing on a commutator, one connected with a battery and the other with a dynamo, and a switch for connecting in either brush.

915,895. ELECTRIC LOCOMOTIVE. Frank L. Sessions, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company. Filed October 24, 1903. Renewed December 9, 1905. A cable-

reeling mechanism for a mining locomotive consists of an electric motor driving a reel shaft through a friction clutch.

915,896. SPARK PLUG. John G. Shea, Detroit, Mich. Filed June 13, 1908. Comprises a tubular nipple with a terminal, an insulating bushing with a terminal therein, and an arm on the upper end of the nipple with a priming cup.

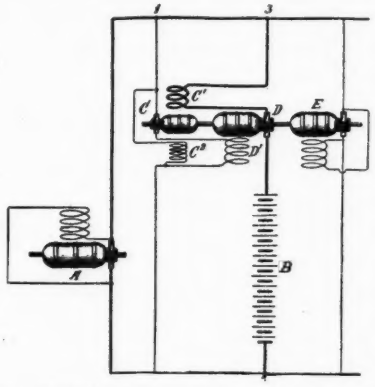
915,915. ELECTRICAL SYSTEM OF DISTRIBUTION. Francis J. White, Brooklyn, N. Y., assignor to Gould Storage Battery Company. Filed January 8, 1906. A storage battery has in series a booster with its field energized by an exciter on the same shaft and having a field shunted across the line and an auxiliary field in series with the booster.

915,939. APPARATUS FOR DYEING YARN. César Corbon, St. Chamond, France. Filed December 14, 1908. A reversible electric motor drives a series of shafts on which are mounted skein-carrying reels.

915,947. ELEVATOR-LEG DRIVE. Scott F. Evans, Minneapolis, Minn. Filed November 1, 1906. A continuously running electric motor is connected by a clutch and gearing to the elevator-driving shaft.

915,951. CONTROLLER FOR ELECTRICALLY-DRIVEN PULSATORS. Arthur H. Gibson, Easton, Pa., assignor to Ingersoll-Rand Company, New York, N. Y. Filed January 4, 1909. Combined with spring contact fingers is a contact drum with cams thereon divided into a number of symmetrical sections arranged to repeat their functions during a revolution of the drum.

915,974. AUTOMATIC THERMO-ELECTRIC CONTROL. Harry W. Leonard, Bronxville, N. Y. Filed January 5, 1906. Combined with a solid heat-producing conductor is a second conductor whose resistance is affected by the first one and means responsive to change in resistance in the second conductor vary the current flowing in the first one.



915,915.—STORAGE BATTERY BOOSTER SYSTEM.

915,980. PROCESS FOR REGENERATING ELECTRIC ACCUMULATORS. Carl Luckow, Cologne, Germany. Filed May 9, 1905. Consists in subjecting the electrodes to electrolysis in a greatly diluted electrolyte of a neutral salt of a light metal.

915,990. JUNCTION-BOX COUPLING. Edward S. Morrell, Philadelphia, Pa. Filed September 25, 1908. Upon the end of the conduit is placed an externally-threaded nipple passing through the hole in the box up to a shoulder; on the end of the nipple is screwed a clamping nut.

915,993. WIRELESS TELEGRAPHY. Joseph Murgas, Wilkes-Barre, Pa. Filed May 17, 1907. A wireless station apparatus comprises on one side a capacity and on the other side an antenna in the shape of a helix passing into and insulated from a tube or well sunk in the earth.

915,997. CORD SUPPORT FOR ELECTRIC LIGHTS. Martin N. Narum, Milwaukee, and Peter L. Jacobson, Norway, Wis. Filed November 5, 1906. A spring-actuated cord-receiving pulley is mounted with stop dogs in a bracket against the ceiling.

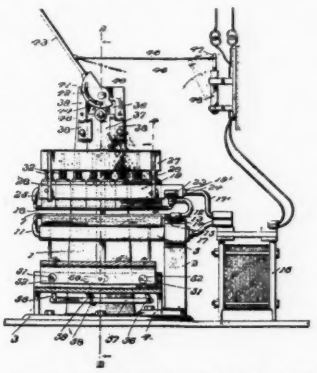
916,033. PROCESS FOR PRODUCING ELECTRODEPOSITS WHICH CAN BE REMOVED FROM THEIR BASE. Harry Schmidt, Cologne, Germany. Filed August 9, 1907. Consists in electrodepositing a metal layer on a rotary cylinder, continuously anodically polarizing the layer and in electrodepositing metal on the first polarized layer.

916,038. TRAIN-SIGNAL SYSTEM. Horace H. Sharp and Willis R. Vanaman, Atlantic City, N. J. Filed June 12, 1908. An electrically-controlled air whistle is operated by the signal cord.

916,039. ELECTRIC SWITCH OR SIGNAL-CONTROLLING APPARATUS. Nelson T. Shaw, Los Angeles, Cal. Filed March 14, 1908. The switch is controlled by two solenoids.

916,065. BRUSH HOLDER. William A. Turbayne, Lancaster, N. Y., assignor to Gould Coupler Company, New York, N. Y. Filed August 8, 1907. A frame is provided with a guide for the carbon brush and a spring-pressed lever is pivoted on the frame and a saddle fixed to the outer end of the carbon.

916,092. ELECTRIC SIGN. Robert E. Belcher, Portland, Ore. Filed October 27, 1908. The sign body is a concave circular drum, on each side of which is supported an electric lamp and beyond it a reflector.

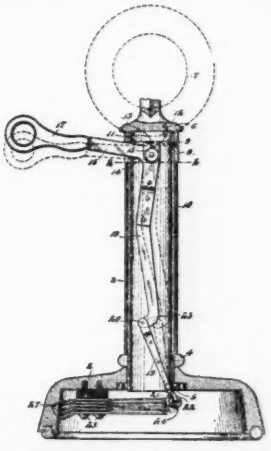


916,140.—ELECTRIC BRAZING MACHINE.

916,117. TESTING SYSTEM FOR TELEPHONE LINES. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed June 29, 1903. A cord circuit with a complete testing strand has a test relay normally isolated therefrom, a listening key for connecting the relay and strand during testing and a supervisory relay for automatically breaking this connection during conversation.

916,119. PHOTOGRAPHIC PRINTING APPARATUS. John A. Dick, Canandaigua, N. Y., assignor to Marie Elizabeth Dick, Canandaigua, N. Y. Filed March 16, 1908. Contains an actinic electric light, a non-actinic electric light, and a switch for throwing either light into circuit when the other is thrown out.

916,140. ELECTRIC BRAZING APPARATUS. Weston M. Fulton, Knoxville, Tenn., assignor to the Fulton Company, Knoxville, Tenn. Filed January 26, 1907. An electrically-heated brazing bar movable into and out of brazing position has automatic means for cutting off the current from the bar when it moves into brazing position.



916,225.—DESK TELEPHONE HOOK SWITCH.

916,142. COMMBINED FIRE-ALARM, TELEGRAPH AND TELEPHONE SYSTEM. Manious Garl, Akron, Ohio. Filed July 23, 1907. There are means for cutting a telephone into the line circuit at each of the alarm boxes.

916,155. ELECTROLYTIC PROCESS. Henry L. Hollis, Chicago, Ill. Filed August 15, 1907. The process of coating iron sheets with tin consists in immersing them as cathodes in an electrolyte consisting of a solution of a tin salt of a fluorine acid and a colloid.

916,167. ENCLOSED FUSE. Philip S. Keefer, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed August 6, 1908. Has a tubular casing and a metallic cap with an internal end plate to which the links are electrically connected and a contact blade secured to the end plate and projecting through an opening in the cap.

916,183. FLOAT-CONTROLLED SWITCH FOR FILLING TANKS. Samuel W. Netherton, Roberts, Ill. Filed August 9, 1907. There is a spring connected with the switch arm for moving it to its open position and a float mechanism for holding the switch arm in its closed position.

916,220. RAILWAY SWITCHING APPARATUS. John D. Taylor, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed April 18, 1904. An electric motor operates a switch and lock movement through a clutch mechanism.

916,223. SYSTEM OF ELECTRICAL CONTROL. Percy H. Thomas, East Orange, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Filed June 19, 1905. A mercury-vapor rectifier has means whereby the vapor path between the several anodes and the cathode may be effectively lengthened independent of the current flowing.

916,235. SUBSCRIBER'S TELEPHONE INSTRUMENT. Alfred H. Weiss, Evanston, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed September 1, 1904. A hook-switch mechanism for telephone desk sets comprises an angular lever pivoted within the stand, switch springs in the base and a link pivotally connecting with the lower end of the lever and with the free end of the springs.

916,245. TELEPHONE-TRANSMITTER ATTACHMENT. Richard L. Woodward, Jersey City, N. J. Filed December 4, 1908. Between the mouthpiece and the transmitter is an intermediate casing containing a plate adapted to be turned so as to exclude sounds from the transmitter.

916,259. DEVICE FOR CONTROLLING ELECTRICALLY-DRIVEN STAGES, LIFTS, AND THE LIKE. August Böhmer, Magdeburg, Germany. Filed February 21, 1908. A mechanically-operated lock is adapted to be released by a regulator operated in the end positions of the stage by the driving motor with a spring-pressed switch held in closed position by means of the lock.

916,266. HEADLIGHT. Frank Buchanan, Dayton, Ohio. Filed June 13, 1907. In a casing are mounted a conoidal reflector and an inverted bracket with an adjustable seat for the incandescent lamp socket.

916,280. FIRE-ALARM SYSTEM. Johannes Dönitz, Leipzig, Germany, assignor to the firm of Oscar Schöppe, Leipzig, Germany. Filed December 28, 1906. Consists of a normally-closed circuit divided into a number of sections, of which one is within the central station, and thermostats in the several outer sections of the circuit each adapted to break the circuit.

916,284. ELECTRIC SIGNAL BELL. Harold W. Eden, Detroit, Mich., assignor to P. R. Manufacturing Company, Detroit, Mich. Filed January 9, 1908. Details of construction of a sheet-metal frame for an electric bell.

916,302. METHOD OF TREATING METALS, SUCH AS STEEL OR STEEL ALLOYS. Charles J. Grist, London, England. Filed December 2, 1907. Consists in passing an electric current through the metal while it is heated to a recalescent point in the presence of mercury.

916,306. LIGHTNING CONDUCTOR AND ANTI-HUMMER. Ed Hall, Waterloo Township, Lyon County, Kan. Filed May 29, 1908. Comprises a block having a longitudinal central bore, a heavy metallic core secured therein, a metallic looped yoke secured in vertical holes, a moist earth connection attached to the lower end of the yoke and a protector covering for the block.

916,312. IGNITION GEAR FOR INTERNAL-COMBUSTION ENGINES. Rudolf Hennig, Zweibrücken, Germany. Filed March 3, 1904. Relates to an adjusting mechanism for controlling the time of ignition.

916,313. SPARK PLUG. Arthur W. S. Herrington, Madison, N. J. Filed May 7, 1908. Connected to the spark plug is a pointed contact member adapted for piercing a cable; wedge-shaped members surround the contact point and are clamped by a nut.

916,320 and 916,321. SECONDARY BATTERY. Henry F. Joel, London, England. Filed July 17 and October 11, 1908. In the first patent the plates are tubular and separated by a perforated cylinder; in the second the plates are flat and separated by inclined strips.

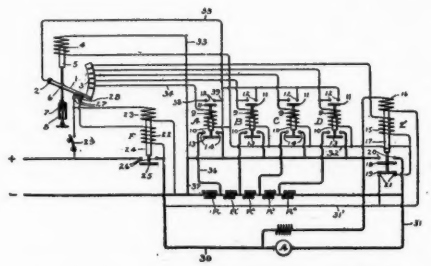
916,332. RAIL-CORRUGATION-FILING-OFF MACHINE. Joseph Lang, Mannheim, Germany. Filed August 27, 1908. A car has electromagnets adapted to attract the rails and thus hold the car, files guided on a frame and adapted to file the upper surfaces of the rails, and means for lifting the wheels off the rails and thus loading the electromagnets.

916,343. MOTOR-STARTING DEVICE. Walter O. Lum, Schenectady, N. Y., assignor to General Electric Company. Filed July 18, 1907. An automatic motor starter consists of electromagnetic switches biased to starting position.

916,348. ELECTRICAL HEATER. Joseph A. Mears, Jr., New York, and Carleton Ellis, Larchmont, N. Y., assignors to Nathaniel L. Foster, trustee, New Rochelle, N. Y. Filed April 7, 1908. Consists of a spindle formed of a number of radial perforated vanes secured together.

916,354. SERVICE-BOX LID. Henry Mueller, Philip Mueller and Anton C. Schuermann, Decatur, Ill., assignors to H. Mueller Manufacturing Company, Decatur, Ill. Filed November 19, 1907. The lid consists of a plate with ears depending therefrom in pairs.

916,355. ELECTRIC CLOSET APPLIANCE. Michael D. Murray, West Homestead, Pa. Filed November 27, 1908. Upon the seat is a pad with a number of electric contacts; the lid carries a battery and a switch for controlling the circuit through the contacts.



916,343.—AUTOMATIC MOTOR STARTER.

916,373. POLARIZED RELAY. Homer J. Roberts, Evanston, and Cyril A. Soans and Albert H. Graves, Chicago, Ill. Original application filed January 8, 1907. Divided and this application filed January 25, 1908. The polarized relay controls means for locking and unlocking a switch member.

916,374. PLATE-HANDLING APPARATUS. James F. Schnabel, New York, N. Y. Filed October 13, 1908. A lifting magnet is provided with safety hooks and means for causing these to engage the plate independent of the magnet lifting means.

916,390. TERMINAL CONNECTOR. Charles Cuno, Meriden, Conn., assignor to the Connecticut Auto Engineering Corporation, Meriden, Conn. Filed March 28, 1908. This is a ball and socket connector.

REISSUE.

12,929. TELEPHONE SYSTEM. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Filed July 1, 1907. Original No. 818,897, dated April 24, 1906. There are means for preventing the magnetization of the receiver due to the flow of direct currents in the line.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 29, 1909:

471,534. SYSTEM FOR TRANSMITTING SIGNALS. H. A. Chase, Boston, Mass.

471,590. SECONDARY BATTERY. C. F. Winkler, Troy, N. Y.

471,591. SECONDARY-BATTERY ELECTRODE. C. F. Winkler, Troy, N. Y.

471,592. SECONDARY BATTERY. C. F. Winkler, Troy, N. Y.

471,612. ELECTRIC SWITCH. H. Hubbell, Bridgeport, Conn.

471,686. AUTOMATIC GUEST CALL. Wm. H. Perry, Chicago, Ill.

471,691. DYNAMO-ELECTRIC GENERATOR OR MOTOR. C. W. Atkinson and L. B. Atkinson, London, England.

471,745. TELEPHONE. J. H. Howard, Medford, Mass.

471,760. ELECTRIC SWITCH. C. G. Perkins, Hartford, Conn.

471,790. ELECTRIC TELPHERAGE APPARATUS. M. W. Hassan, Rochester, N. Y.

471,913. ELECTRIC LOCK. J. G. Thompson, Boston, Mass.

471,929. AUTOMATIC ELECTRIC FIRE ALARM. L. G. Wooley, Grand Rapids, Mich.

471,945. GALVANIC BATTERY. Wm. Burnley, North East, Pa.

471,986 and 471,987. ELECTRICAL ANNUNCIATOR. N. M. Watson, Detroit, Mich.

471,997. AUTOMATIC ELECTRIC CUT-OUT. E. A. Manship, Minneapolis, Minn.

472,019. METHOD OF, AND APPARATUS FOR, PRODUCING MUSICAL TONES BY ELECTROMAGNETISM. E. C. Ohmart, Detroit, Mich.